Cisco CRS-1 Carrier Routing System 4-Slot Line Card Chassis Installation Guide

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Preface

This preface explains the objectives, intended audience, and organization of *Cisco CRS-1 Carrier Routing System 4-Slot Line Card Chassis Installation Guide* and describes the conventions that convey instructions and other information.

The preface contains the following sections:

- Objective
- Audience
- Document Organization
- Document Conventions
- Related Documentation
- Changes to This Document
- Obtaining Documentation
- Documentation Feedback
- Cisco Product Security Overview
- Product Alerts and Field Notices
- Obtaining Technical Assistance
- Obtaining Additional Publications and Information

Objective

This installation guide describes how to install components into and remove them from a Cisco CRS-1 4-slot line card chassis. This installation guide does not provide background information and basic theory-of-operation for anyone wanting to understand the Cisco CRS-1 Carrier Routing System.

Audience

This guide is intended for Cisco CRS-1 4-slot line card chassis installers and Cisco installation partners who are responsible for installing the line card chassis components. The chassis installers are expected to have installed networking hardware in the past. No additional knowledge of routing or the Cisco IOS XR software is assumed.

Document Organization

This guide contains the following chapters and appendixes:

- Chapter 1, "Overview," provides an introduction to the various line card chassis systems and components. This chapter also provides the recommended sequence of tasks for installing all the major components of the Cisco CRS-1 4-slot line card chassis.
- Chapter 2, "Installing and Removing Power Components," details how to bring power to and install power components in the line card chassis, including the AC and DC power shelves power supplies, and alarm module.
- Chapter 3, "Installing and Removing Air Circulation Components," describes how to install the fan trays and air filters.
- Chapter 4, "Installing and Removing SFCs, RPs, MSCs, PLIMs, and Associated Components," provides instructions on how to install various cards, including PLIMs, switch fabric cards, and modular services cards.
- Chapter 5, "Installing and Removing the Doors and Grille," documents how to install and remove the optional exterior components, the front doors and grille.
- Appendix A, "Cisco CRS-1 4-Slot Line Card Chassis System Specifications," lists the technical specifications for the Cisco CRS-1 4-slot line card chassis.

Document Conventions

This guide uses the convention where the symbol ^ represents the key labeled *Control*. For example, the key combination **^z** means hold down the **Control** key while you press the **z** key.

Command descriptions use these conventions:

- Examples that contain system prompts denote interactive sessions, indicating the commands that you should enter at the prompt. The system prompt indicates the current level of the EXEC command interpreter. For example, the prompt `router>` indicates that you should be at the *user* level, and the prompt `router#` indicates that you should be at the *privileged* level. Access to the privileged level usually requires a password. Refer to the related software configuration and reference documentation listed in "Related Documentation" for additional information.
- Commands and keywords are in **boldface** font.
- Arguments for which you supply values are in *italic* font.
- Elements in square brackets ([ ]) are optional.
- Alternative but required keywords are grouped in braces ({ }) and separated by vertical bars (|).

Examples use these conventions:

- Terminal sessions and sample console screen displays are in `screen` font.
- Information you enter is in **`boldface screen`** font.
- Nonprinting characters, such as passwords, are in angle brackets (< >).
- Default responses to system prompts are in square brackets ([]).
- Exclamation points (!) at the beginning of a line indicate a comment line.

Caution Means *reader be careful*. You are capable of doing something that might result in equipment damage or loss of data.

Note Means *reader take note*. Notes contain helpful suggestions or references to materials not contained in this manual.

Timesaver Means *the described action saves time*. You can save time by performing the action described in the paragraph.

Warning **This warning symbol means *danger*. You are in a situation that could cause bodily injury. Before you work on any equipment, be aware of the hazards involved with electrical circuitry and be familiar with standard practices for preventing accidents. To see translations of the warnings that appear in this publication, refer to the *Regulatory Compliance and Safety Information* document that accompanied this device.** Statement 1074

Related Documentation

For complete planning, installation, and configuration information, refer to the following documents:

- Cisco CRS-1 Carrier Routing System Hardware Documentation Guide
- Cisco CRS-1 Carrier Routing System 4-Slot Line Card Chassis Site Planning Guide
- Cisco CRS-1 Carrier Routing System 4-Slot Line Card Chassis System Description
- Cisco CRS-1 4-Slot Line Card Chassis Unpacking, Moving, and Securing Guide
- Cisco CRS-1 Carrier Routing System Gigabit Ethernet Physical Layer Interface Module (PLIM) Installation Note
- Cisco CRS-1 Carrier Routing System Packet-over-SONET Physical Layer Interface Module (PLIM) Installation Note
- Cisco CRS-1 Carrier Routing System Fiber-Optic Cleaning Guide
- Cisco CRS-1 Carrier Routing System Regulatory Compliance and Safety Information

For a complete listing of software documentation available, refer to *About Cisco IOS XR Software Documentation*, available online at

http://www.cisco.com/univercd/cc/td/doc/product/core/crs/xrabout.htm.

Changes to This Document

Table 1-1 lists the technical changes made to this document since it was first printed.

Table 1-1 Changes to This Document

Revision	Date	Change Summary
OL-10971-07	May 2008	New procedures on installing and removing a pillow block were added to Chapter 4, "Installing and Removing SFCs, RPs, MSCs, PLIMs, and Associated Components."
OL-10971-06	March 2008	Minor editorial changes.
OL-10971-05	August 2007	Technical updates were made to Chapter 2, "Installing and Removing Power Components."
OL-10971-04	June 2007	Added "Recommended Chassis Installation Task Sequence" in Chapter 1, "Overview," and reorganized and revised Chapter 4, "Installing and Removing SFCs, RPs, MSCs, PLIMs, and Associated Components." Also added "Removing a DC Power Shelf" in Chapter 2, "Installing and Removing Power Components."
OL-10971-03	March 2007	Added "DC Power Systems on the Cisco CRS-1 4-Slot Router", "Installing a DC Power Shelf", in Chapter 2, "Installing and Removing Power Components." Also updated Appendix A, "Cisco CRS-1 4-Slot Line Card Chassis System Specifications," with DC power specifications and other updates.
OL-10971-02	November 2006	Added Chapter 5, "Installing and Removing the Doors and Grille."
OL-10971-01	November 2006	Initial release of the document

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- For nonemergencies—psirt@cisco.com

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http://www.cisco.com/en/US/products/products_security_vulnerability_policy.html

The link on this page has the current PGP key ID in use.

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Access to all tools on the Cisco Technical Support & Documentation website requires a Cisco.com user ID and password. If you have a valid service contract but do not have a user ID or password, you can register at this URL:

http://tools.cisco.com/RPF/register/register.do

Note Use the **Cisco Product Identification Tool** to locate your product serial number before submitting a request for service online or by phone. You can access this tool from the Cisco Technical Support & Documentation website by clicking the **Tools & Resources** link, clicking the **All Tools (A-Z)** tab, and then choosing **Cisco Product Identification Tool** from the alphabetical list. This tool offers three search options: by product ID or model name; by tree view; or, for certain products, by copying and pasting **show** command output. Search results show an illustration of your product with the serial number label location highlighted. Locate the serial number label on your product and record the information before placing a service call.

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To find technical information, narrow your search to look in technical documentation, not the entire Cisco.com website. On the Cisco.com home page, click the **Advanced Search** link under the Search box and then click the **Technical Support & Documentation** radio button.

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To open a service request by telephone, use one of the following numbers:

Asia-Pacific: +61 2 8446 7411
Australia: 1 800 805 227
EMEA: +32 2 704 55 55
USA: 1 800 553 2447

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  http://www.cisco.com/univercd/cc/td/doc/abtunicd/136957.htm

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CHAPTER 1

Overview

This chapter introduces the Cisco CRS-1 Carrier Routing System 4-Slot Line Card Chassis at the highest level. It contains illustrations of the front and back of the chassis, complete with callouts to each hardware component. For details on each subsystem discussed in this chapter, see *Cisco CRS-1 Carrier Routing System 4-Slot Line Card Chassis System Description*. This chapter also provides the recommended task sequence for installing the major components in the chassis.

This chapter presents the following topics:

- Chassis Overview
- Chassis Components
- Chassis Slot Numbers
- Chassis Cable Management
- Chassis Cooling System
- Chassis Power System
- Safety Guidelines
- Preventing Electrostatic Discharge
- Recommended Chassis Installation Task Sequence

Chassis Overview

The Cisco CRS-1 4-slot routing system can be installed in locations where the 16-slot or 8-slot systems may not fit (for example, colocation facilities, data centers, and many Tier II and Tier III locations). The routing system consists of a single rack-mounted chassis that contains the following system components:

- Switch fabric cards (SFCs) (up to four)
- Route processor (RP) cards (up to two)
- Modular services cards (MSCs), also called line cards, (up to four)
- Physical layer interface modules, or PLIMs, (up to four, one for each MSC)
- A chassis midplane that connects MSCs to their associated PLIMs and to the SFCs

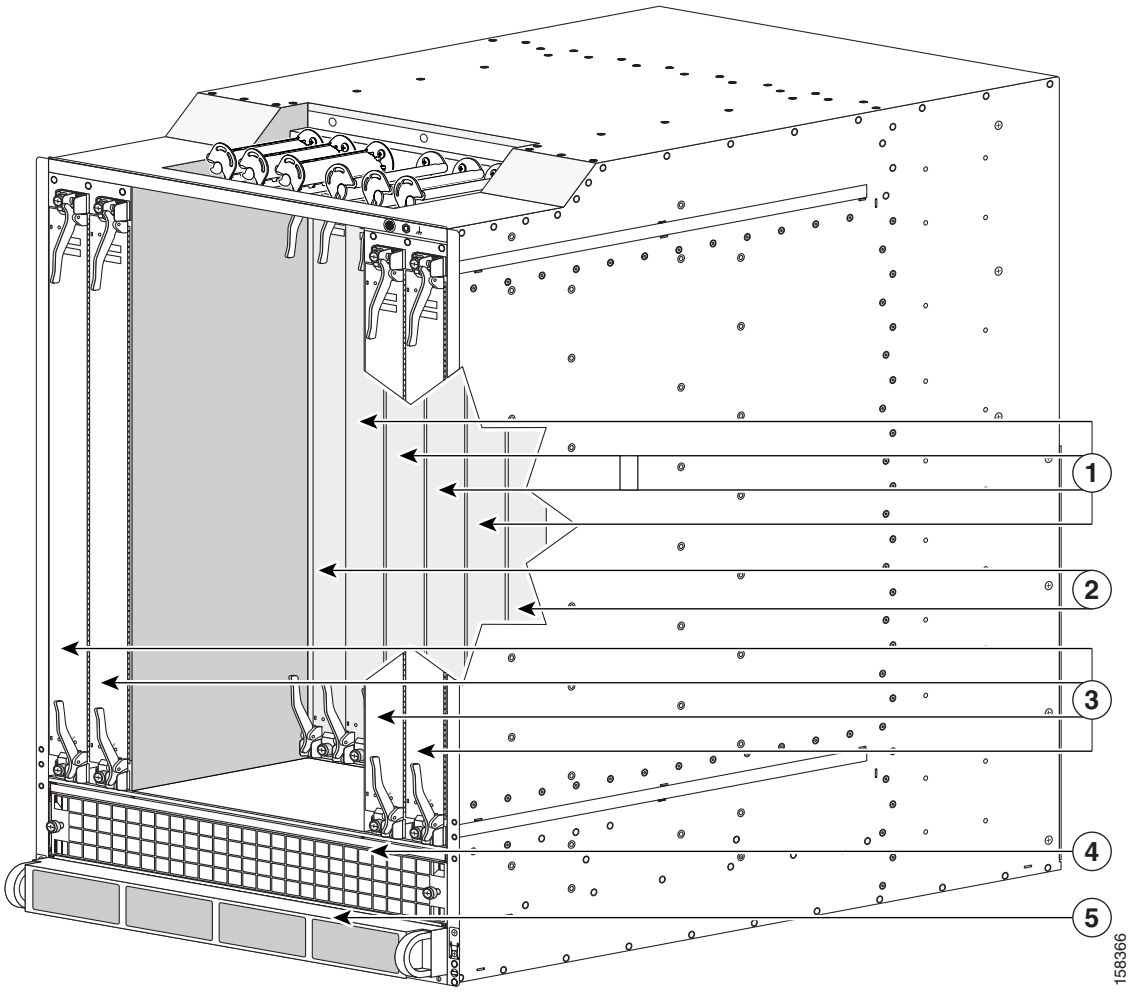
The Cisco CRS-1 4-slot line card chassis has its own power and cooling subsystems. The power shelf (AC or DC as ordered) is pre-installed in the chassis when you receive the routing system.

Chassis Components

This section lists the main components of a Cisco CRS-1 4-slot line card chassis. It primarily identifies the components that are considered field-replaceable units (FRUs), but where additional detail is useful this section identifies subassemblies that are not field replaceable.

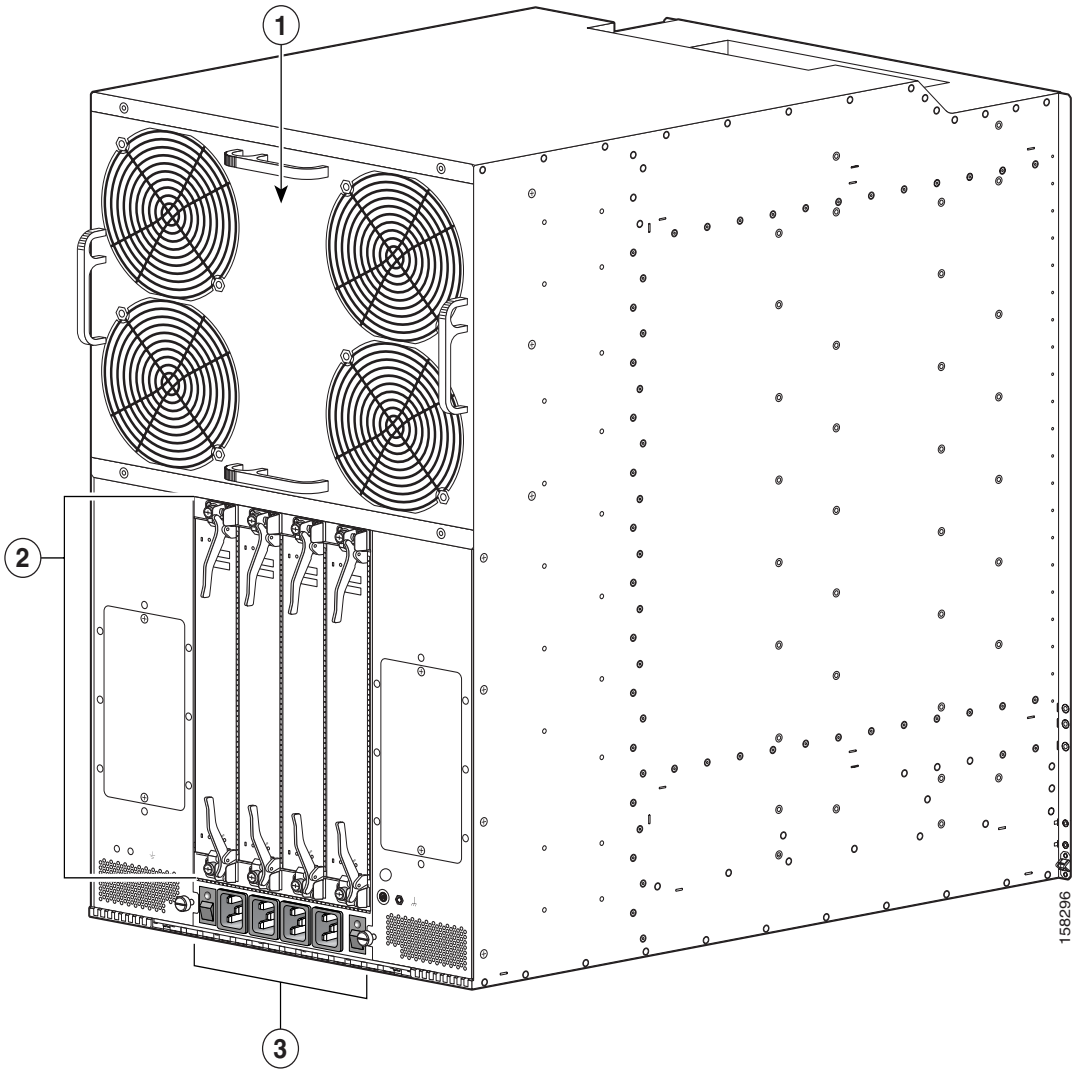
Figure 1-1 and Figure 1-2 show the Cisco CRS-1 4-slot line card chassis from both the front (PLIM) and rear (SFC) sides.

Figure 1-1 Front (PLIM) View of Cisco CRS-1 4-Slot Line Card Chassis



1	PLIM slots	**4**	Air intake
2	RP slots	**5**	Power supplies (behind air filter)
3	MSC slots		

Figure 1-2 Rear (SFC) View of the Cisco CRS-1 4-Slot Line Card Chassis



1	Fan tray	**3**	Switch fabric card slots
2	AC power plug connectors		

The Cisco CRS-1 4-slot line card chassis contains the following components:

- As many as four modular services cards (MSCs, also called *line cards*) and four physical layer interface modules (PLIMs). The MSC and PLIM are an associated pair of cards that mate through the chassis midplane. The MSC provides the forwarding engine for Layer 3 routing of user data, and the PLIM provides the physical interface and connectors for the user data.

  An MSC can be associated with several different PLIMs that provide different interface speeds and technologies. For a full list of available PLIMs, please contact your Cisco sales representative.

- A chassis midplane that connects MSCs to their associated PLIMs. The midplane design allows an MSC to be removed from the chassis without having to disconnect the cables that are attached to the associated PLIM. The midplane distributes power, connects the MSCs to the switch fabric cards, and provides control plane interconnections. The midplane is not field replaceable by the customer.

- One or two route processor cards (RPs). The RPs function as the Cisco CRS-1 4-slot line card chassis system controller and provide route processing.

  Only one RP is required for system operation. For redundant operation, you can order a second RP as an option (CRS-4-RP/R). When two RPs are used, only one RP is active at a time. The second RP acts as a "standby" RP, serving as a backup if the active RP fails.

  The RP also monitors system alarms and controls the system fans. LEDS on the front panel indicate active alarm conditions.

- Fan tray. The fans pull cool air through the chassis. A removable air filter is located below the PLIM card cage at the front of the chassis. The fan tray has four fans that provide n+1 redundancy.

- Four switch fabric cards (SFCs). These cards provide the three-stage Benes switch fabric for the routing system. The switch fabric performs the cross-connect function of the routing system, connecting every MSC (and its associated PLIM) with every other MSC (and its associated PLIM) in the system.

  The switch fabric receives user data from one MSC and PLIM pair and performs the switching necessary to route the data to the appropriate egress MSC and PLIM pair. The switch fabric is divided into eight logical planes (four physical planes) that are used to evenly distribute the traffic across the switch fabric. Each switch fabric card implements two planes of the switch fabric.

- A power system that provides redundant power to the chassis. The power system consists of an AC power shelf, which contains four AC rectifier modules, or a DC power shelf, which encloses four DC power supplies. The power shelf (AC or DC as ordered) is pre-installed in the chassis when you receive the routing system.

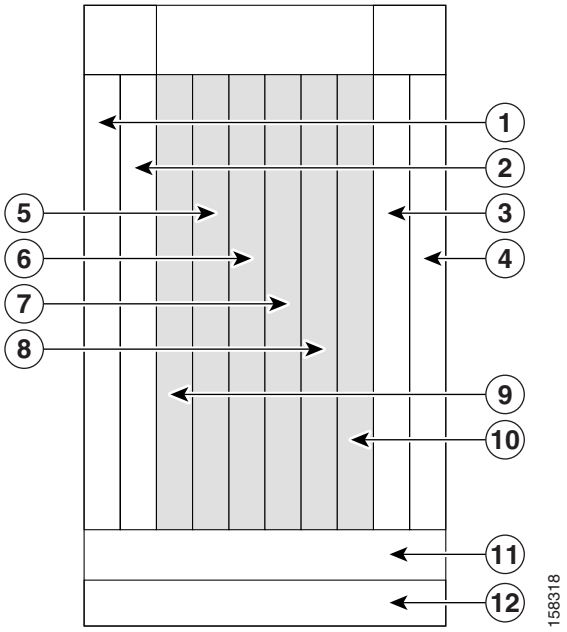
The PLIM side of the chassis is considered the front of the chassis, where user data cables attach to the PLIMs and cool air enters the chassis. The switch fabric card side, which is where warm air is exhausted, is considered to be the rear of the chassis.

Chassis Slot Numbers

This section identifies the location and slot numbers for major cards and modules (primarily the field-replaceable units) that plug into the Cisco CRS-1 4-slot line card chassis.

Figure 1-3 shows the slot numbering on the front (PLIM) side of the Cisco CRS-1 4-slot line card chassis.

Figure 1-3 Cisco CRS-1 4-Slot Chassis Slot Numbering—Front (PLIM) Side



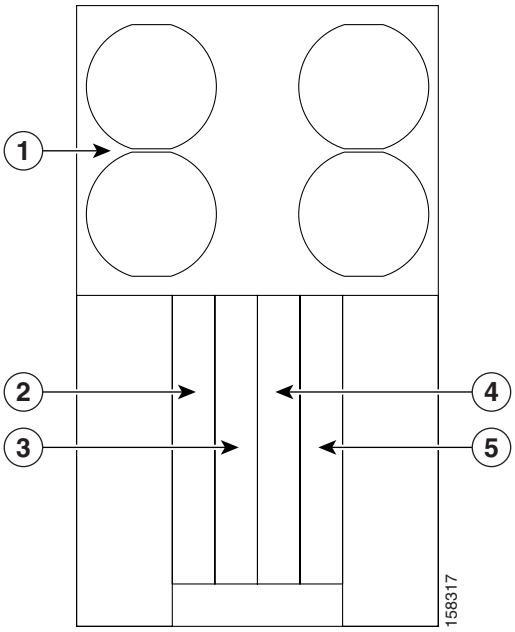
1	MSC slot 0	**7**	PLIM slot 2
2	MSC slot 1	**8**	PLIM slot 3
3	MSC slot 2	**9**	RP slot (RP0)
4	MSC slot 3	**10**	RP slot (RP1)
5	PLIM slot 0	**11**	Air intake
6	PLIM slot 1	**12**	Power shelf (AC or DC)

As shown in Figure 1-3, the Cisco CRS-1 4-slot line card chassis numbers on the PLIM side of the chassis include the card cage with the following assignments:

- Four MSC slots (left to right, 0, 1, 2, 3)
- Four PLIM slots (left to right, 0, 1, 2, 3)
- Two route processor card slots, RP0 and RP1

Figure 1-4 shows the slot numbers on the rear (Switch Fabric Card) side of the Cisco CRS-1 4-slot line card chassis.

Figure 1-4 Cisco CRS-1 4-Slot Chassis Slot Numbering—Rear (SFC) Side



1	Fan tray (FT0)	**4**	Switch fabric card slot (SM1)
2	Switch fabric card slot (SM3)	**5**	Switch fabric card slot (SM0)
3	Switch fabric card slot (SM2)		

As shown in Figure 1-4, the slot numbers on the SFC side of the chassis include:

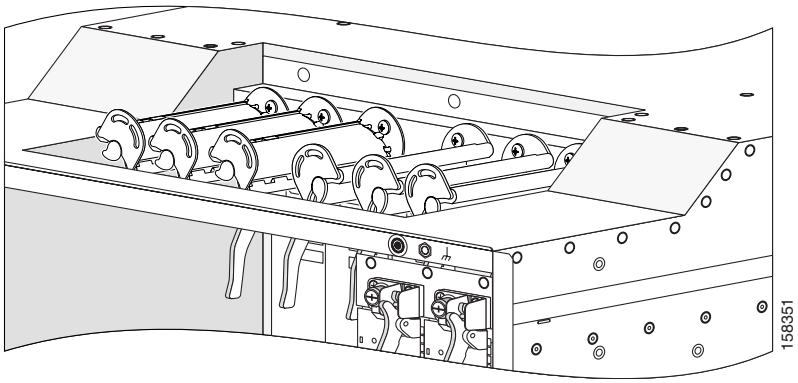
- Fan tray
- Card cage, including four reduced-height SFC slots (SM0 to SM3, right to left)

Chassis Cable Management

The Cisco CRS-1 4-slot line card chassis has cable management features for the front (PLIM) side of the chassis, just above the card cage. The horizontal cable management trays have a special telescoping feature that allows them to be extended when the chassis is upgraded with higher-density cards. This extension also helps when installing the cables in the chassis.

Figure 1-5 shows the cable management bracket for the chassis.

Figure 1-5 Cable Management Bracket



Chassis Cooling System

The Cisco CRS-1 4-slot line card chassis has a single fan tray containing four fans that cool the chassis card cage. Cool air flows in at the bottom front of the chassis and flows through the chassis card cage and through the fans in the fan tray before being expelled through the top rear of the chassis (see Figure 1-6).

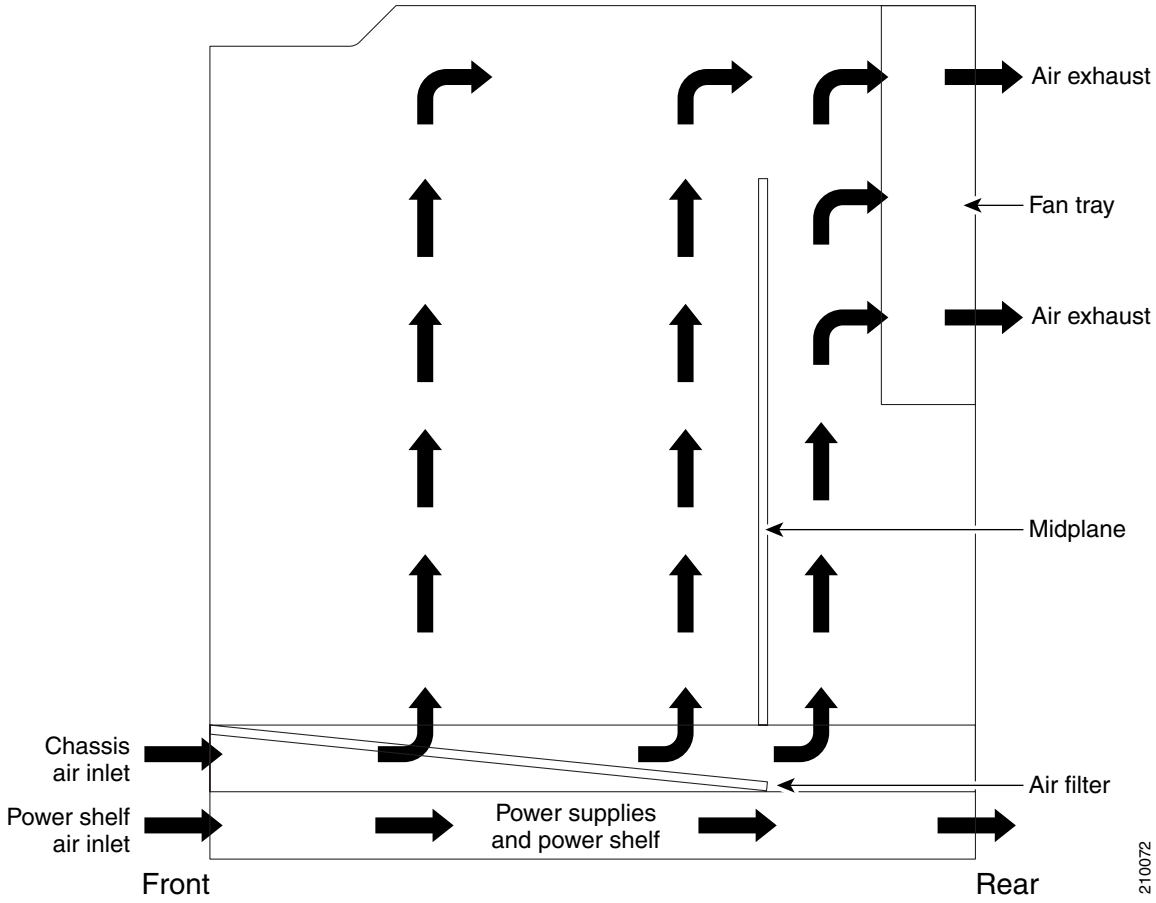
In addition, each power module at the bottom of the chassis has self-contained fans that pull in cool air from the front of the chassis and exhaust warm air out the rear. Air also flows under the midplane, through the SFCs, and then the fans to be expelled. There are these two parallel paths for air flow.

A replaceable air filter is located inside the chassis below the PLIM card cage at an angle. In addition, there is a removable air filter on the front of the power tray air intake grille on the front (PLIM) side of the chassis.

How often the air filters should be replaced depends on the facility environment. In a dirty environment, or when you start getting frequent temperature alarms, you should always check the intake grille for debris, and then check the air filters to see if they need to be replaced.

Note We recommend that you check the air filters once a month. Replace a filter when you notice a significant amount of dust.

Figure 1-6 Airflow Through the Cisco CRS-1 4-Slot Line Card Chassis



The Cisco CRS-1 4-slot line card chassis airflow volumes are as follows:

- Chassis airflow: Up to 880 cubic feet (24,919 liters) per minute
- Power system airflow: Up to 60 cubic feet (1,699 liters) per minute

Chassis Power System

The Cisco CRS-1 Carrier Routing System 4-Slot Line Card Chassis can be configured with either an AC-input power subsystem or a DC-input power subsystem. The AC power trays are configured for single-phase AC power module wiring. The power modules and power trays have separate Cisco part numbers. For additional information, see the appropriate sections in Chapter 2, "Installing and Removing Power Components."

Safety Guidelines

Before you perform any procedure in this document, review the safety guidelines in this section to avoid injuring yourself or damaging the equipment.

The following guidelines are for your safety and to protect equipment. The guidelines do not include all hazards. Be alert.

Note Review the safety warnings listed in *Regulatory Compliance and Safety Information* that are applicable to your router before installing, configuring, or troubleshooting any installed card.

- Keep the work area clear and dust-free during and after installation. Do not allow dirt or debris to enter into any laser-based components.
- Do not wear loose clothing, jewelry, or other items that could get caught in the router while working with MSCs, PLIMs, or their associated components.
- Cisco equipment operates safely when used in accordance with its specifications and product-usage instructions.

Warning **This unit is intended for installation in restricted access areas. A restricted access area is where access can only be gained by service personnel through the use of a special tool, lock and key, or other means of security, and is controlled by the authority responsible for the location.** Statement 37

Warning **Only trained and qualified personnel should be allowed to install or replace this equipment.** Statement 49

Warning **High leakage current—earth connection essential before connecting to system power supply.** Statement 342

Warning **The chassis should be mounted on a rack that is permanently affixed to the building.** Statement 1049

Preventing Electrostatic Discharge

Electrostatic discharge (ESD) damage, which can occur when electronic cards or components are improperly handled, results in complete or intermittent failures. We recommend to use an ESD-preventive strap whenever you handle network equipment or one of its components.

Following are guidelines for preventing ESD damage:

- Always use an ESD-preventive wrist or ankle strap and ensure that it makes good skin contact. Connect the equipment end of the connection cord to an ESD connection socket on the router or to a bare metal surface on the chassis.
- Handle a card by its ejector levers, when applicable, or the card's metal carrier only; avoid touching the board or connector pins.
- Place a removed card board-side-up on an antistatic surface or in a static-shielding bag. If you plan to return the component to the factory, immediately place it in a static-shielding bag.
- Avoid contact between the card and clothing. The wrist strap protects the board only from ESD voltage on the body; ESD voltage on clothing can still cause damage.

Recommended Chassis Installation Task Sequence

This section provides the recommended task sequence for installing a new Cisco CRS-1 4-slot line card chassis.

Step 1 If your system was shipped with AC power, remove the four AC power cords from the box, and do the following:

a. Insert all four power cords into the AC power source.

b. Insert the power cords into the AC power plugs at the base of the rear of the chassis.

Step 2 Turn the power enable switches (for your AC or DC power system) to the ON position. For details, see the "Powering the Chassis Up or Down" section on page 2-4.

All power should come up properly. The LEDs above the enable switches should be lit green. The fans in the front of the chassis should start operating.

Step 3 Install the switch fabric cards (SFCs). For the procedure, see the "How to Install or Remove a Switch Fabric Card" section on page 4-18.

Step 4 Install the route processors (RPs). For the procedure, see the "How to Install or Remove a Route Processor Card" section on page 4-25.

Step 5 Install the modular service cards (MSCs). For the procedure, see the "How to Install or Remove a Modular Services Card" section on page 4-33.

Step 6 Install the physical layer interface modules (PLIMs). For the procedure, see the "How to Install or Remove a Physical Layer Interface Module" section on page 4-41.

Step 7 If the system was shipped with the grille and doors, install the inlet grille. See the "Installing the Inlet Grille" section on page 5-2.

Step 8 Install the doors. See the "Installing the Doors" section on page 5-4.

CHAPTER 2

Installing and Removing Power Components

This chapter provides instructions on how to install and remove the Cisco CRS-1 Carrier Routing System 4-Slot Line Card Chassis power components.

This chapter presents the following topics:

- About Installing and Removing the Power Components
- DC Power Systems on the Cisco CRS-1 4-Slot Router
- Installing a DC Power Shelf
- Removing a DC Power Shelf
- Installing an AC Power Shelf
- Removing an AC Power Shelf
- Installing a Power Supply
- Removing a Power Supply

About Installing and Removing the Power Components

This section contains some general information about the power components.

- Basic Chassis Power Recommendations
- Supplemental Unit Bonding and Grounding Guidelines
- Powering the Chassis Up or Down

Basic Chassis Power Recommendations

The Cisco CRS-1 Carrier Routing System 4-Slot Line Card Chassis can be configured with either an AC-input power subsystem or a DC-input power subsystem. Site power requirements differ depending on the source voltage used. Follow these precautions and recommendations when planning power connections to the router:

- Check the power at your site before installation and periodically after installation to ensure that you are receiving clean power. Install a power conditioner, if necessary.
- Install proper grounding to avoid damage from lightning and power surges.

Caution A Cisco router must be operated with all its power modules installed at all times for electromagnetic compatibility (EMC).

The Cisco CRS-1 4-slot line card chassis requires that at least the power shelves and their components be installed to operate properly. Two types of power shelves exist: an AC shelf and a DC shelf. An AC power shelf houses AC rectifiers, while a DC power shelf houses the DC power input module (PIM) and DC power input shelf (which encloses the DC power supplies). We recommend that you use only one type of power shelf in a chassis at a time.

Warning **This unit might have more than one power supply connection. All connections must be removed to de-energize the unit.** Statement 1028

The Cisco CRS-1 4-slot line card chassis is shipped fully populated with a power shelf that contains four power supplies for power redundancy. See the appropriate installation section (see "Installing a DC Power Shelf" section on page 2-11 or "Installing an AC Power Shelf" section on page 2-22) for detailed installation information.

As viewed from the front (PLIM) side of the chassis, the left two power supplies feed output A, while the right two power supplies feed output B.

For 2N redundancy, the power input on rear (SFC) side of the chassis should be from two different branch sources, with the left two input connections to one branch source and the right two to the other branch source. With this configuration the router remains fully powered in case one branch source fails. In normal operation all power supplies should be installed.

Be sure to install the power shelf **before** installing the power supplies.

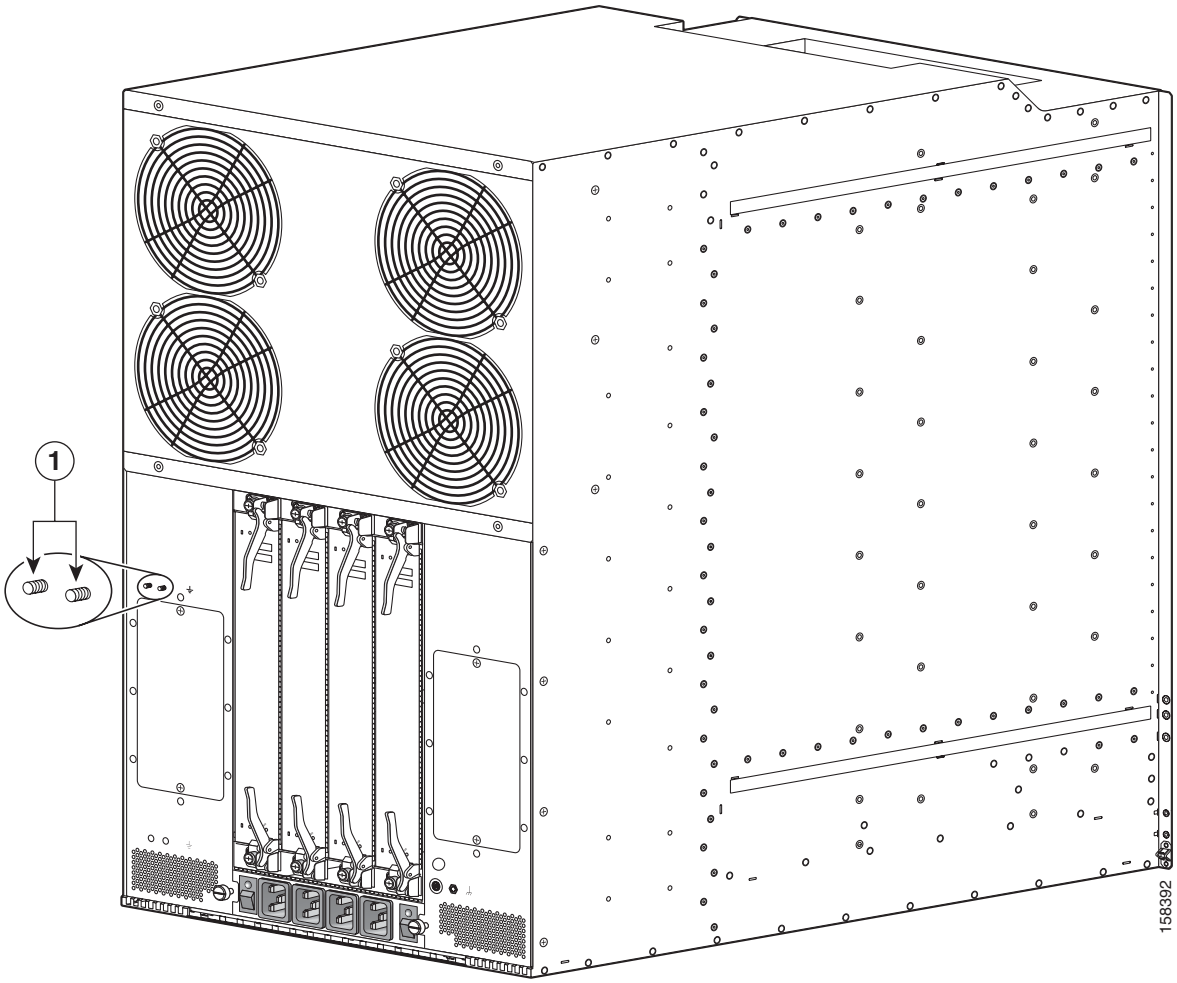
Caution If you install a non-Cisco power supply in the chassis, upon its detection as a non-compliant power supply, the system will shut down. Using non-Cisco power supplies MAY RESULT IN COMPLETE CHASSIS SHUTDOWN due to insufficient power.

Supplemental Unit Bonding and Grounding Guidelines

Although the router chassis has a safety earth ground connection as part of the power cabling to the power shelf, the chassis includes an option that allows you to connect the central office ground system or interior equipment ground system to the supplemental bonding and grounding receptacles on the router chassis. Two ground studs are located on the rear (SFC) side of the chassis. (see Figure 2-1). This ground point is also called the *network equipment building system* (NEBS) bonding and grounding stud.

Note These bonding and grounding receptacles satisfy the Telcordia® NEBS requirements for supplemental bonding and grounding connections. If you are not installing the router in a NEBS environment, you can choose to bypass these guidelines and rely on the safety earth ground connection for the power shelf.

Figure 2-1 NEBS Bonding and Grounding Points (Rear of Chassis)



1	NEBS bonding and grounding stud		

If you plan to connect the Cisco CRS-1 4-slot line card chassis system to a network equipment building system (NEBS)-compliant supplemental bonding and grounding system at the site, you must have the following:

- A minimum of one ground lug that has two M6 bolt holes with 0.625-inch (15.86-mm) spacing between them, and a wire receptacle large enough to accept a 6-AWG or larger multistrand copper wire. The lug is similar to the type used for the DC-input power supply leads. This ground lug is not available from Cisco Systems. This type of lug is available from electrical-connector vendors, such as Panduit.
- Two M6 nuts with locking washers (nickel-plated brass is ideal). This hardware is not available from Cisco Systems; they are available from any commercial hardware vendor.
- A commensurately rated ground wire. The actual wire diameter and length depend on your router location and site environment. This wire is not available from Cisco Systems; it is available from any commercial cable vendor.

Note The DC return of this system should remain isolated from the system frame and chassis (DC-I: Isolated DC Return).

Powering the Chassis Up or Down

The chassis does not have a single enable switch that powers the entire chassis and all its components up and down. (These switches are called enable switches because they enable the power supplies to produce output voltage and power).Most components on the chassis, such as the power supplies, MSCs, PLIMs, and fan trays can be removed or installed in the chassis while it is running.

Before you can power the chassis up, you must complete the following tasks:

Step 1 Install the appropriate power shelf for your system (see the "Installing a DC Power Shelf" section on page 2-11 or the "Installing an AC Power Shelf" section on page 2-22).

Step 2 Install the power supplies (see the "Installing a Power Supply" section on page 2-25).

Step 3 Install the route processor (RP) card (see the "Installing an RP Card" section on page 4-26).

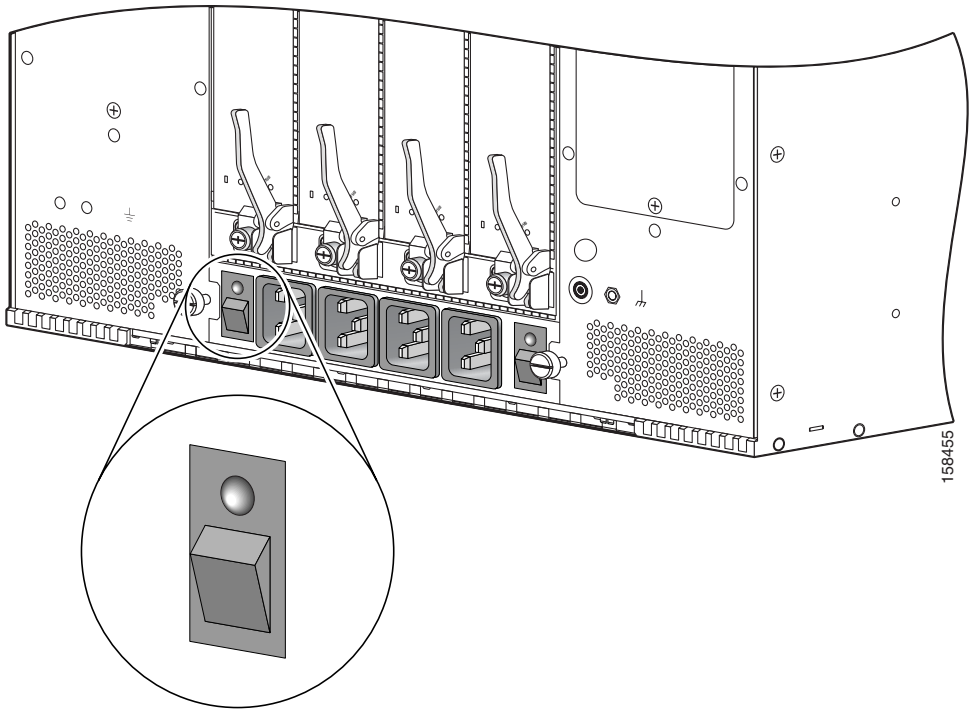
Step 4 Install the input power cables to the input power connectors on the rear of the chassis, and the other end (plug side) to the AC or DC power source.

Step 5 Activate your power source.

Step 6 Turn the two power shelf enable switches on the rear (SFC) side of the power shelf (see Figure 2-2) to the ON position.

Note The two enable switches on the rear (SFC) side of the AC power shelf (Figure 2-2) put the chassis in standby mode; in other words, they only power down the -54VDC output from the power supplies.

Figure 2-2 AC Power Enable Switches



For an illustration of the DC power enable switches, see Figure 2-14 on page 2-19.

Note All power cords must be unplugged from wall power to fully remove power from the chassis.

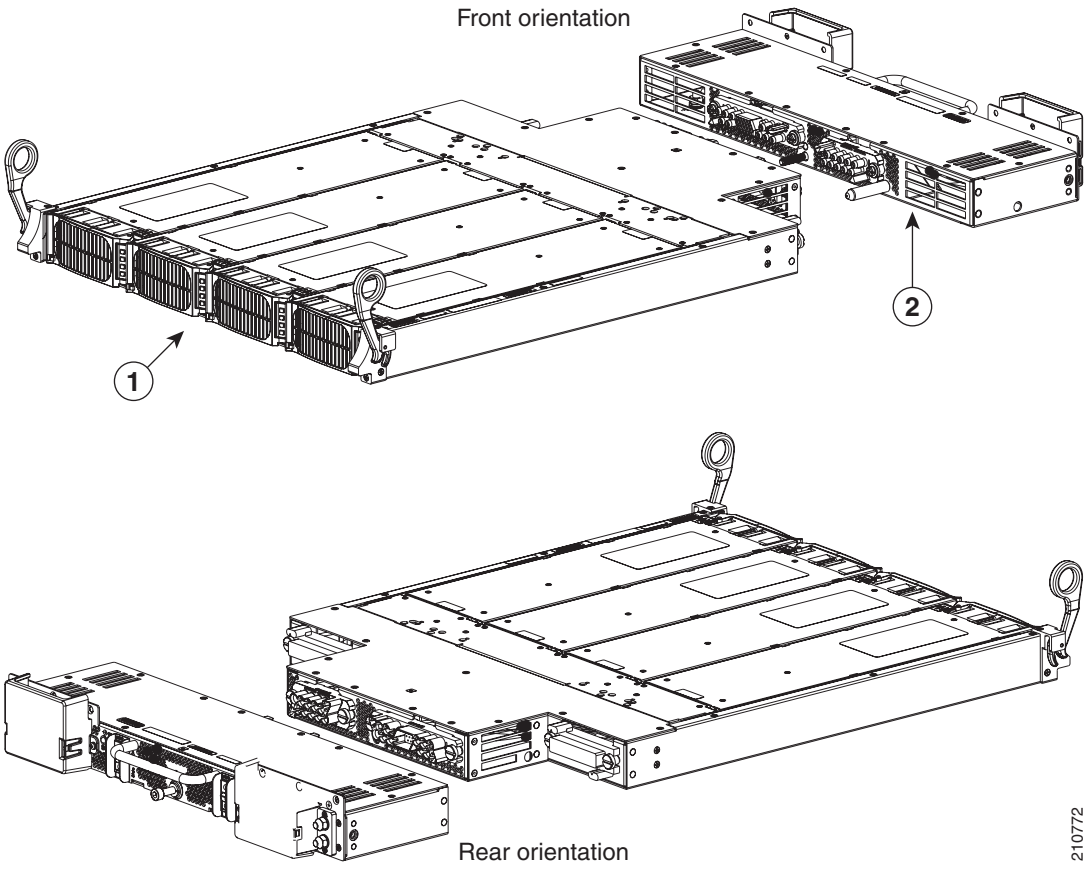
DC Power Systems on the Cisco CRS-1 4-Slot Router

The Cisco CRS-1 4-slot line card chassis DC power shelf consists of two major components, as shown in Figure 2-3:

- DC power input shelf (Cisco product number: CRS-4-DC-INPUT)

  Figure 2-3 shows the power supplies installed in the DC power input shelf.
- DC power input module (PIM) (Cisco product number: CRS-4-DC-PIM)

Figure 2-3 DC Power Shelf: DC Power Input Shelf and DC Power Input Module (PIM)



1	DC power input shelf	**2**	Power input module (PIM)

When installing the DC power shelf, these two components are mated to create the complete DC power shelf (see the "Installing a DC Power Shelf" section on page 2-11 for details).

The Cisco CRS-1 4-slot line card chassis DC power system provides 4,000 watts to power the chassis. (To provide power redundancy, up to 8,000 watts are available.) Each DC-powered chassis contains four DC power supplies for 2N redundancy. The power input module (PIM) provides the input power connections. Note that each power connection has two cables: -48 VDC and return. The power input module (PIM), DC power input shelf, and the power supplies are field replaceable.

The Cisco CRS-1 4-slot line card chassis requires a total of four dedicated pairs of 60-A DC input power connections, one pair for each of the power supplies, to provide redundant DC power to the Cisco CRS-1 4-slot line card chassis midplane.

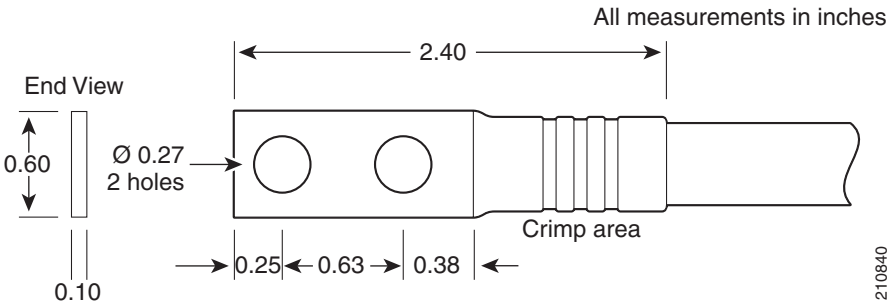
For full 2N redundancy, we recommend that you have two independent -48 VDC power sources to provide power to the Cisco CRS-1 4-slot line card chassis. Connect the two 60-A DC inputs on the left to one wiring block, and the two 60-A DC inputs on the right to the other wiring block.

DC Power Shelf Guidelines

At sites where the Cisco CRS-1 4-slot line card chassis is equipped with a DC power input shelf and power supplies, observe the following guidelines:

- All power connection wiring should follow the rules and regulations in the National Electrical Code (NEC) and any local codes.
- Each DC-input power entry module connection is rated at 60-A maximum. A dedicated, commensurately rated DC power source is required for each power supply connection.
- Each power supply requires one -48 VDC input, or four inputs for each power shelf (in which each input consists of a pair of positive and negative wires), and one power-shelf grounding wire.
- For DC power cables, we recommend that you use commensurately rated, high-strand-count copper wire cable. Each DC power supply requires one -48 VDC input, which means that there are two wires for each power supply, or eight total wires (four pairs) for each power shelf, plus the grounding wire. The length of the wires depends on the router's location. These wires are not available from Cisco Systems; they are available from any commercial vendor.
- DC power cables must be terminated by cable lugs at the power-shelf end. The lugs should be dual hole and able to fit over M6 terminal studs at 0.625-in (15.88-mm) centers (for example, Panduit part number LCD2-14A-Q or equivalent) (see Figure 2-4).

Figure 2-4 DC Power Cable Lug



Color Coding of the Source DC Power Cable

The color coding of the source DC power cable leads depends on the color coding of the site DC power source. Typically, green or green and yellow indicates that the cable is a ground cable. Because no color code standard exists for the source DC wiring, you must ensure that the power cables are connected to the DC-input power shelf terminal studs in the proper positive (+) polarity and negative (–) polarity.

DC Cable Polarity Labels

Sometimes, the source DC cable leads might have a positive (+) or a negative (–) label. This label is a relatively safe indication of the polarity, but you must verify the polarity by measuring the voltage between the DC cable leads. When making the measurement, the positive (+) lead and the negative (–) lead must always match the (+) and (–) labels on the power shelf.

Caution The DC-input power supplies contain circuitry to prevent damage due to reverse polarity, but you should correct a reverse-polarity condition immediately.

Table 2-1 DC Input Current and Voltage Information

Nominal input voltage	Supports -48 VDC and -60 VDC systems (range: –40 to –72 VDC) **Note** The *turn-on* voltage of the DC power supplies is -43.5 +/- 0.5 VDC. When a power supply is powered on, it continues to operate down to an input voltage of -40 VDC.
Input line current	50-A maximum at –48 VDC 40-A maximum at –60 VDC
Inrush current	60-A peak at -75 VDC (maximum for 1 ms)

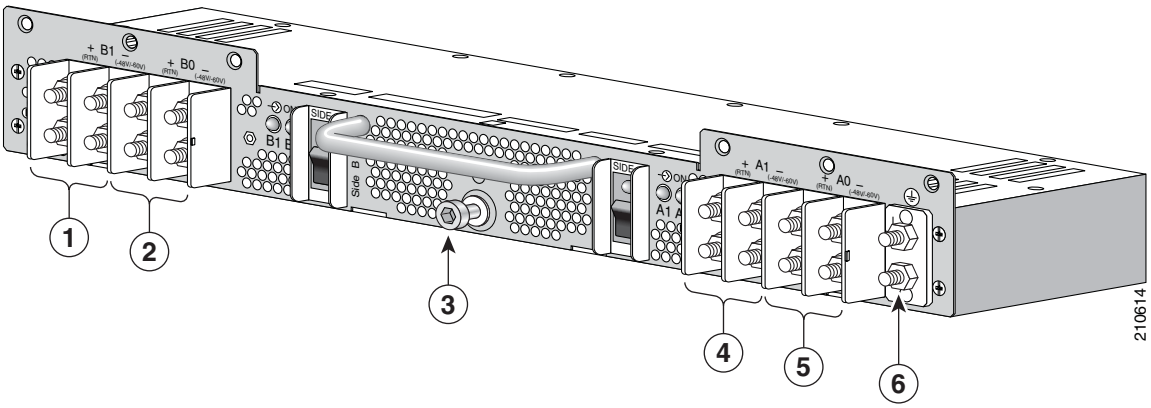
Note When wiring the DC power shelf, be sure to attach the ground wire first. When removing the wiring, be sure to remove the ground wire last. The ground wire must be attached with a torque value of 30 in-lb. The power cables should also be attached with a torque value of 30 in-lb.

Wiring Block on the PIM

Each wiring block on the power input module (PIM) contains four sets of terminals, two positive and two negative (see Figure 2-5). Each wiring block is covered by a plastic block cover that snaps onto the wiring block and is secured by a screw to a torque value of 50 in.-lb.

You must remove the block cover before you work with the wires.

Figure 2-5 Power Input Module (PIM)



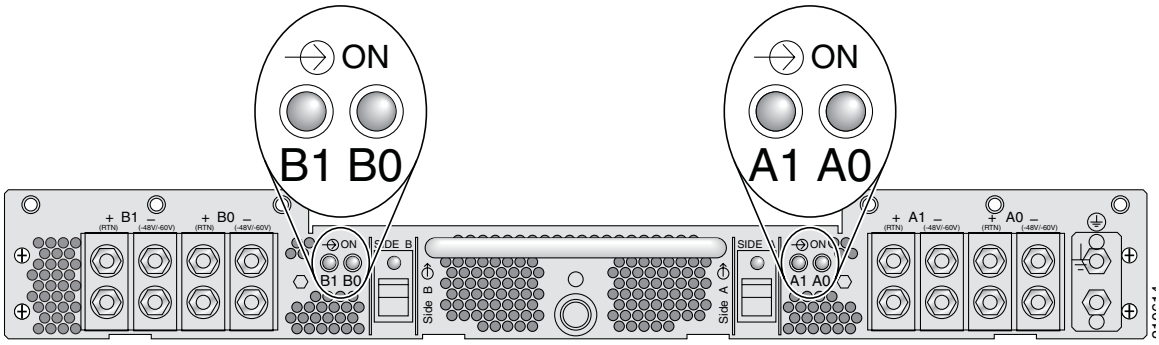
1	Power supply B1 wiring block	**4**	Power supply A1 wiring block
2	Power supply B0 wiring block	**5**	Power supply A0 wiring block
3	Power shelf coupling screw	**6**	Ground lug nuts

Input-Power-Present LEDs

The DC power Input-Power-Present LEDs provide a visual indication to service personnel that there is voltage present across the input terminal's connections (see Figure 2-6). The LED provides a warning to the service person that there is power present.

Note Power should be disconnected before servicing the input power connections. Always check for hazardous voltage with a multimeter device before servicing the router.

Figure 2-6 Input-Power-Present LEDs



The input-power-present LED starts to light up when the input voltage reaches 20 VDC; the LED gets brighter as voltage increases. The input-power-present LED is fully lit when the input voltage reaches 38 VDC.

Note If an input-power-present LED is not lit, check for: 1) the presence of voltage, and 2) the polarity of the corresponding wiring block.

DC Power Wire Characteristics

For signal degradation to be averted, a conductor must be large enough to prevent its impedance from creating a voltage drop equal to 2 percent of the reference voltage. Also, the gauge of the earth conductor must be equal to or larger then that of the -48VDC (or -48 VDC return) conductor. This latter requirement is for safety. Full fault redundancy is achieved by having conductors of equal size for the protective earth ground and the -48 VDC return of the switch.

For site preparation, proper wire size and insulation must be selected. For a planned power distribution, calculation must be done prior to distribution to meet the proper voltage drop and temperature rise.

For wire gauges that prevent unacceptable voltage drops over different lengths of copper wire, see Table 2-2. For the resistance of 1000 feet of copper wire for each gauge of wire, see Table 2-3. These references are for planning purposes and might be further subject to local laws and practices.

Table 2-2 provides the gauges of wire needed for wire lengths and DC power currents. The units of measurement are in American wire gauge (AWG).

Note Table 2-2 and Table 2-3 are for reference; we recommend using at least 50-A of DC current and 6-gauge wire.

Table 2-2 Wire Gauge for Current Loads Over Copper Wire Lengths

DC Current (Amps)	25 Feet	50 Feet	75 Feet	100 Feet	150 Feet	200 Feet	400 Feet
5 A	18 AWG	14 AWG	14 AWG	12 AWG	10 AWG	8 AWG	6 AWG
10 A	14 AWG	12 AWG	10 AWG	8 AWG	8 AWG	6 AWG	2 AWG
15 A	14 AWG	10 AWG	8 AWG	8 AWG	6 AWG	4 AWG	2 AWG
20 A	12 AWG	8 AWG	8 AWG	6 AWG	4 AWG	2 AWG	0 AWG
25 A	12 AWG	8 AWG	6 AWG	4 AWG	4 AWG	2 AWG	0 AWG
30 A	10 AWG	8 AWG	6 AWG	4 AWG	2 AWG	2 AWG	00 AWG
35 A	10 AWG	6 AWG	4 AWG	2 AWG	2 AWG	1 AWG	000 AWG
40 A	8 AWG	6 AWG	2 AWG	2 AWG	2 AWG	0 AWG	000 AWG
45 A	8 AWG	6 AWG	4 AWG	2 AWG	1 AWG	0 AWG	0000 AWG
50 A	8 AWG	4 AWG	4 AWG	2 AWG	1 AWG	00 AWG	N/A
55 A	8 AWG	4 AWG	2 AWG	2 AWG	0 AWG	00 AWG	N/A
60 A	8 AWG	4 AWG	2 AWG	2 AWG	0 AWG	00 AWG	N/A
65 A	6 AWG	4 AWG	2 AWG	1 AWG	0 AWG	000 AWG	N/A
70 A	6 AWG	4 AWG	2 AWG	1 AWG	00 AWG	000 AWG	N/A
75 A	6 AWG	4 AWG	2 AWG	1 AWG	00 AWG	000 AWG	N/A
100 A	4 AWG	2 AWG	1 AWG	00 AWG	000 AWG	N/A	N/A

Table 2-3 provides the correlation between wire gauge and the resistance (in Ohms for each 1000 feet of wire) for copper wire.

Table 2-3 Resistance for Each Gauge of Copper Wire

Wire Gauge (AWG)	Ohms for Each 1000 Feet of Wire
0000 AWG	0.0489
000 AWG	0.0617
00 AWG	0.0778
0 AWG	0.098
1 AWG	0.1237
2 AWG	0.156
3 AWG	0.1967
4 AWG	0.248
5 AWG	0.3128
6 AWG	0.3944
7 AWG	0.4971
8 AWG	0.6268
9 AWG	0.7908
10 AWG	0.9968

Table 2-3 Resistance for Each Gauge of Copper Wire (continued)

Wire Gauge (AWG)	Ohms for Each 1000 Feet of Wire
11 AWG	1.257
12 AWG	1.5849
13 AWG	1.9987
14 AWG	2.5206
15 AWG	3.1778
16 AWG	4.0075
17 AWG	5.0526
18 AWG	6.3728
19 AWG	8.0351
20 AWG	10.1327
21 AWG	12.7782
22 AWG	16.1059

Installing a DC Power Shelf

This section describes how install a DC power shelf in the Cisco CRS-1 4-slot line card chassis. For installations in which AC power is currently installed, this section also describes how to convert your Cisco CRS-1 4-slot line card chassis from AC power to DC power.

The DC power shelf encloses four power supplies and the power distribution connections and wiring. The DC power input shelf is installed in the front of the chassis; the power input module (PIM) is installed in the rear of the chassis.

We recommend that you have two separate, redundant -48 VDC power battery sources to provide power to the Cisco CRS-1 4-slot line card chassis. Connect the two input pair 60-A DC inputs on the left to one -48 VDC power source, and the input pair 60-A DC inputs on the right to the other -48 VDC power source.

Sequence of Tasks

The sequence of tasks required to install the DC power shelf is as follows:

1. Remove the rear power access panels.
2. Install the DC power input module (PIM).
3. Install the DC power input shelf.
4. Mate and secure the power input module to the DC power input shelf.
5. Connect the grounding cable and the power input cables.
6. Install the DC power supplies.

Prerequisites

Bring down the power to the Cisco CRS-1 4-slot line card chassis.

Tip We recommend that you do this procedure with the line card chassis mounted in a rack with sufficient space for bottom and side access to the screws.

Required Tools and Equipment

You need the following tools and parts to perform this task:

- ESD-preventive wrist strap
- Medium flat-blade screwdriver
- Number 1 Phillips screwdriver
- Medium Phillips screwdriver
- 5 mm Allen wrench
- 10 mm hex socket wrench
- DC power input shelf (Cisco product number: CRS-4-DC-INPUT)
- DC power input module (PIM) (Cisco product number: CRS-4-DC-PIM)
- DC power supplies (Cisco product number: CRS-4-DC-SUPPLY)

Note This procedure assumes that the Cisco CRS-1 4-slot line card chassis is already mounted in a rack with sufficient room to access the sides and the bottom of the chassis.

Steps

To install the DC power shelf, follow these steps:

Step 1 Attach the ESD-preventive wrist strap to your wrist and connect its leash to one of the ESD connection sockets on the front (PLIM) side of the chassis or a bare metal surface on the chassis.

Step 2 If the AC power shelf is currently installed, remove it from the front of the chassis. (For details, see the "Removing an AC Power Shelf" section on page 2-23.)

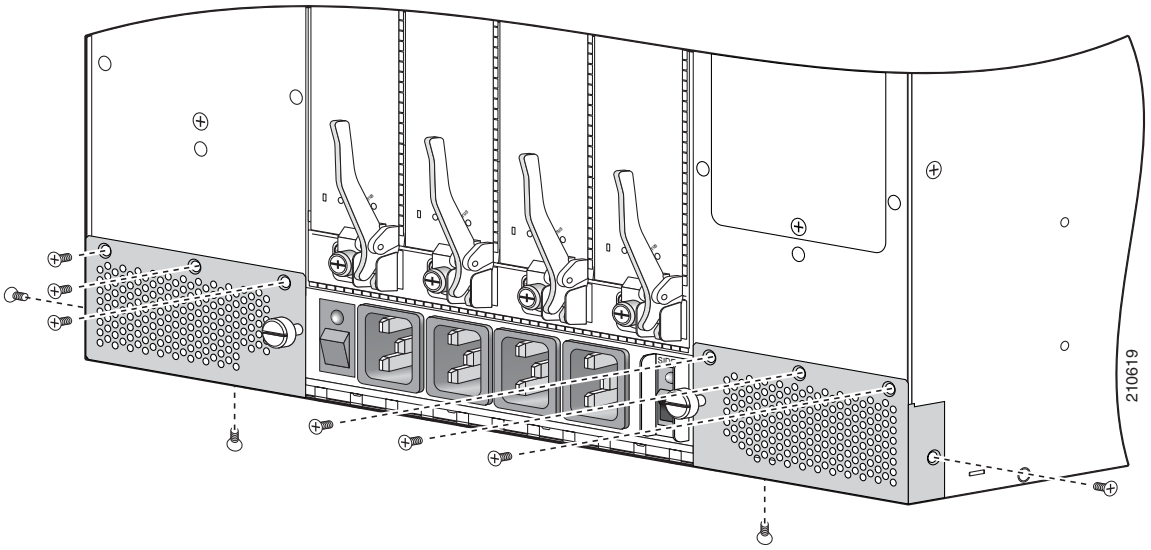
Removing the Rear Power Access Panels

Before you can install the power input module, you must remove the rear power access panels.

Step 3 From the rear of the chassis, use a medium Phillips screwdriver to remove the rear power access panels (located on the bottom right and bottom left rear of the chassis). Remove the screws shown in Figure 2-7.

Tip One screw on each side is located under the chassis (as indicated in Figure 2-7). To access this screw safely, the chassis must be in a rack with adequate space below the chassis.

Figure 2-7 Removing the Rear Power Access Panels



Step 4 Unscrew the coupling screw from each panel with a medium flat-blade screwdriver. Set aside the access panels and their screws.

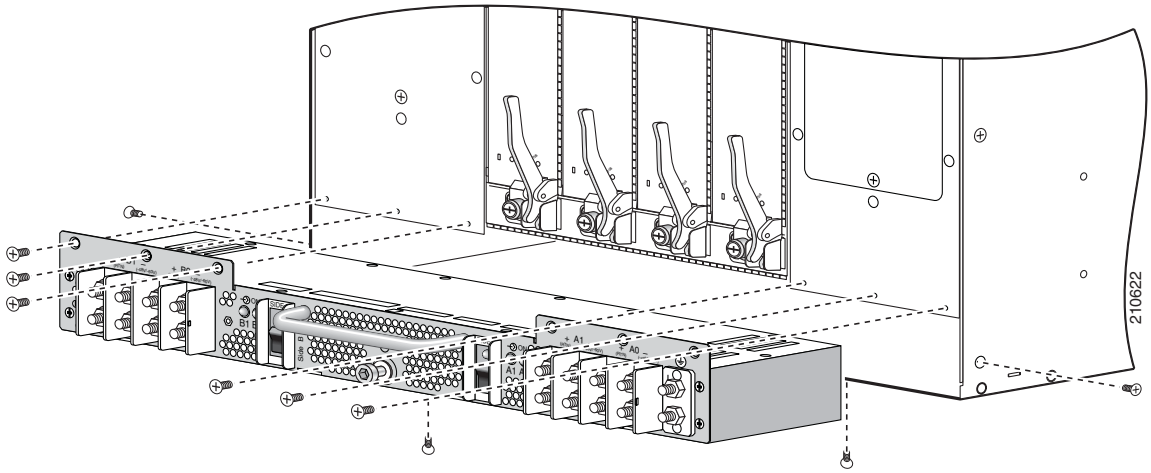
Note You will need these screws later when you install the power input module (PIM).

Installing the DC Power Input Module

Step 5 From the rear of the chassis, insert the DC power input module (PIM) into the open power bay (see Figure 2-8).

Note The PIM weighs 6.5 lb (2.9 kg).

Figure 2-8 Inserting the DC Power Input Module (PIM)



Step 6 Reinsert the No. 2 Phillips screws taken from the rear power access panels into their respective holes: one on each side, three in front, and one underneath the chassis.

Installing the DC Power Input Shelf

Caution The DC power input shelf can only be inserted into the chassis when all power is removed from the chassis.

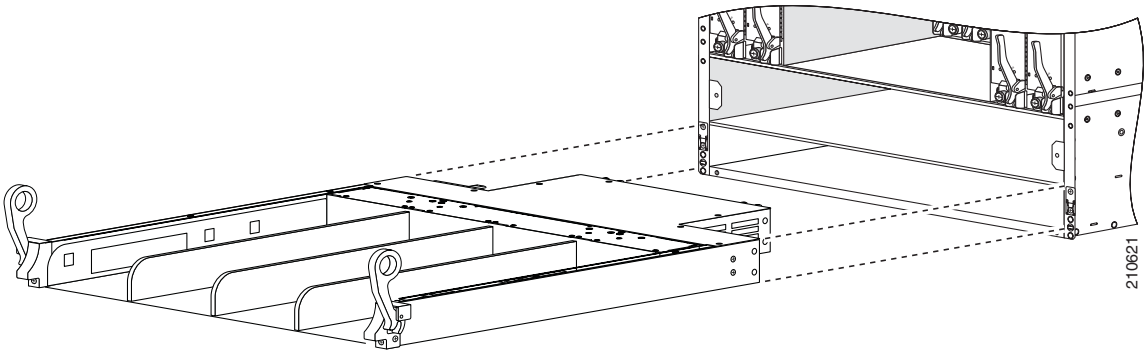
Step 7 Go to the front of the chassis. To install the DC power input shelf, follow these steps:

a. To prepare the chassis for installing the DC power input shelf, remove the inlet grille from the bottom of the chassis (for the procedure, see the "Removing the Inlet Grille" section on page 5-3).

b. Holding the DC power input shelf underneath with one hand and steadying it with the other, lift the DC power input shelf up and slide it part way into the power shelf slot on the front (PLIM) side of the chassis. Be sure to center the DC power input shelf in the slot when you slide it in (see Figure 2-9).

Caution An empty DC power input shelf weighs approximately 15.5 lb (7 kg).
To prevent injury when lifting the shelf, keep your back straight and lift with your legs, not your back. Avoid sudden twists or lateral moves.

Figure 2-9 Inserting the DC Power Input Shelf



c. Slide the DC power input shelf fully into the chassis. Be sure that the lever handles are aligned with the lever handle catches on the chassis casing.

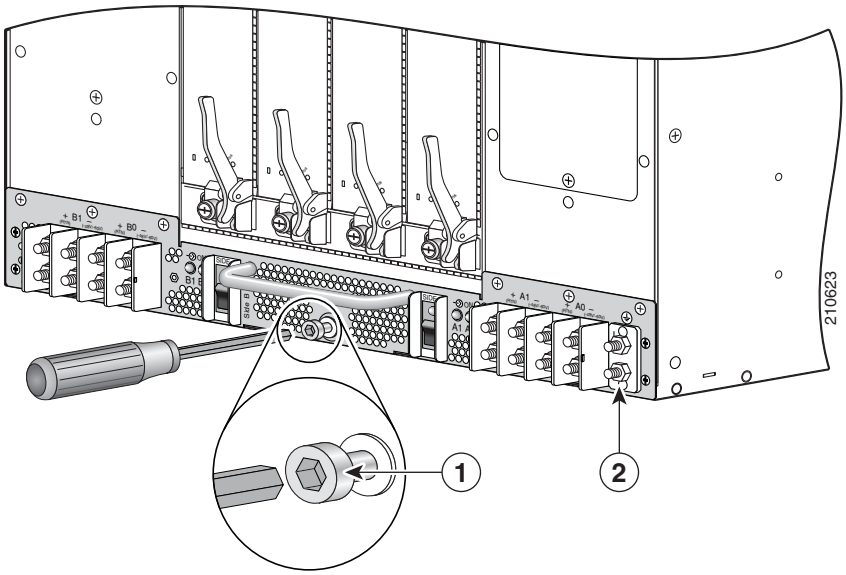
d. To lock the power input shelf into position, lift the lever handles up.

Securing the PIM to the DC Power Input Shelf

Step 8 Go to the rear of the chassis. To mate the PIM to the DC power input shelf, push the PIM firmly but carefully into the power input shelf.

Step 9 To secure the input power module connections to the power input shelf, use a 5 mm Allen wrench to tighten the power shelf coupling screw into the DC power input shelf (see Figure 2-10).

Figure 2-10 Power Shelf Coupling Screw



1	Power shelf coupling screw	**2**	Ground lug nuts

Connecting the Grounding Cable and Power Input Cables

Step 10 On the PIM, use a 10 mm hex socket wrench to connect the grounding cable (see item 2 in Figure 2-10).

Note When wiring the power shelf, be sure to attach the ground wire first. When removing the wiring, be sure to remove the ground wire last. The ground wire must be attached with a torque value of 30 in-lb.

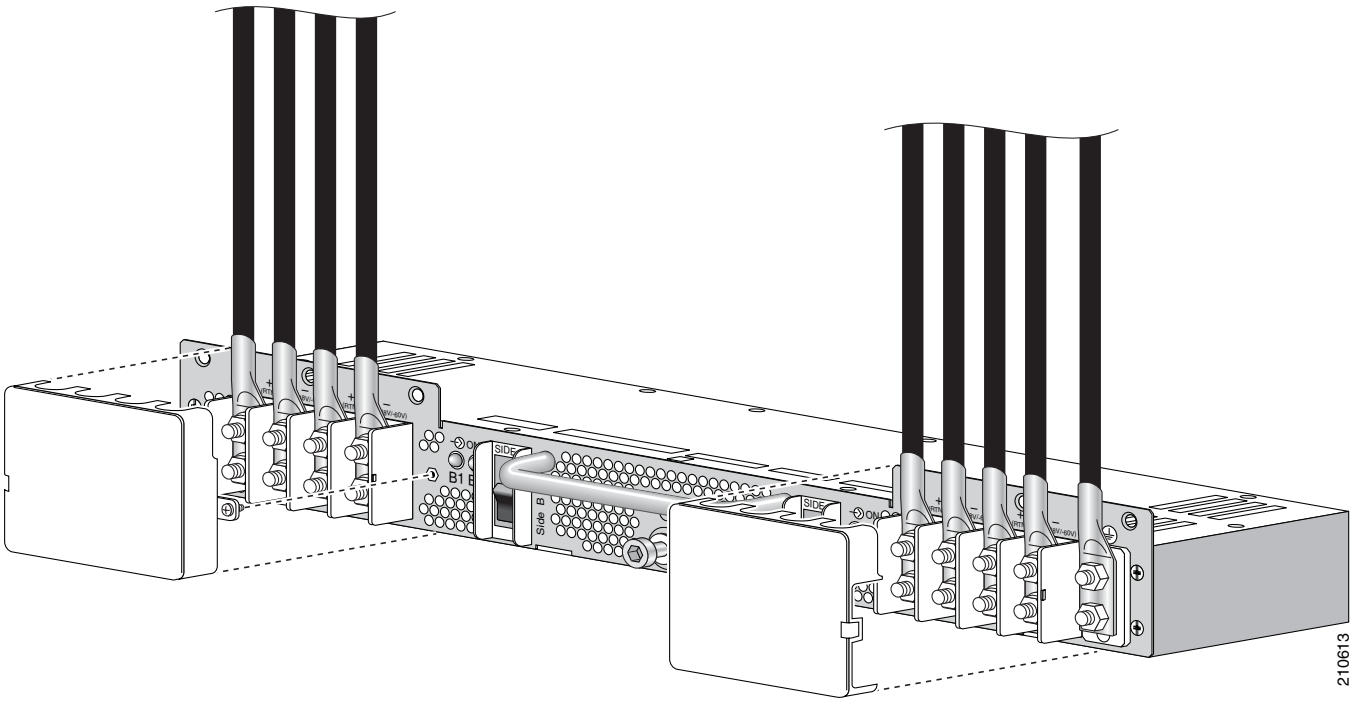
Step 11 On the PIM, use a 10 mm hex socket wrench to hook up the DC input power cables. Connect the four 60A DC cables (two cables per input) on the left to one wiring block, and the four 60A DC cables on the right to the other wiring block (see Figure 2-11).

Note The DC input power cables should also be attached with a torque value of 30 in-lb.

Color Coding of the Source DC Power Cable. The color coding of the source DC power cable leads depends on the color coding of the site's DC power source. Typically, green or green and yellow indicates that the cable is a ground cable. Because no color code standard exists for the source DC wiring, you must ensure that the power cables are connected to the DC-input power shelf terminal studs in the proper positive (+) polarity and negative (–) polarity.

DC Cable Polarity Labels. Sometimes, the source DC cable leads might have a positive (+) or a negative (–) label. This label is a relatively safe indication of the polarity, but you must verify the polarity by measuring the voltage between the DC cable leads. When making the measurement, the positive (+) lead and the negative (–) lead must always match the (+) and (–) labels on the power shelf.

Figure 2-11 DC Power Shelf Cable Cabling



Step 12 Reattach both wiring block covers (see Figure 2-11).

a. Snap the cover over the wiring block so that it snaps closed.

b. Use a number 1 Phillips screwdriver to tighten the capture screw.

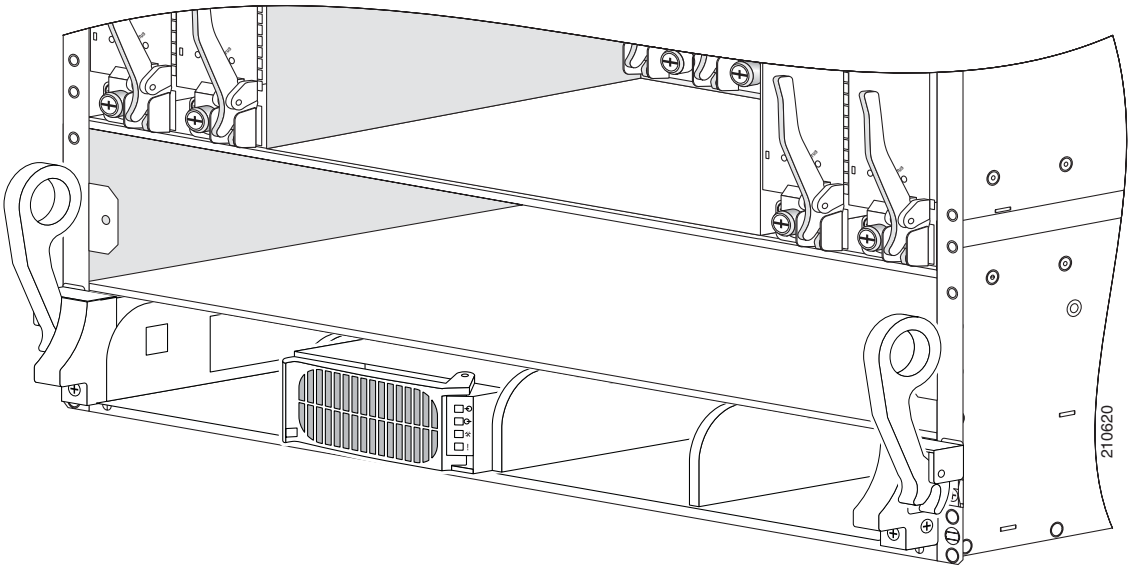
Note The wiring block covers can be oriented to route the wire cabling from the top or the bottom of the covers.

Installing the DC Power Supplies

Step 13 Go to the front of the chassis. Install the four DC power supplies into the power input shelf (see Figure 2-12). For details, see the "Installing a Power Supply" section on page 2-25.

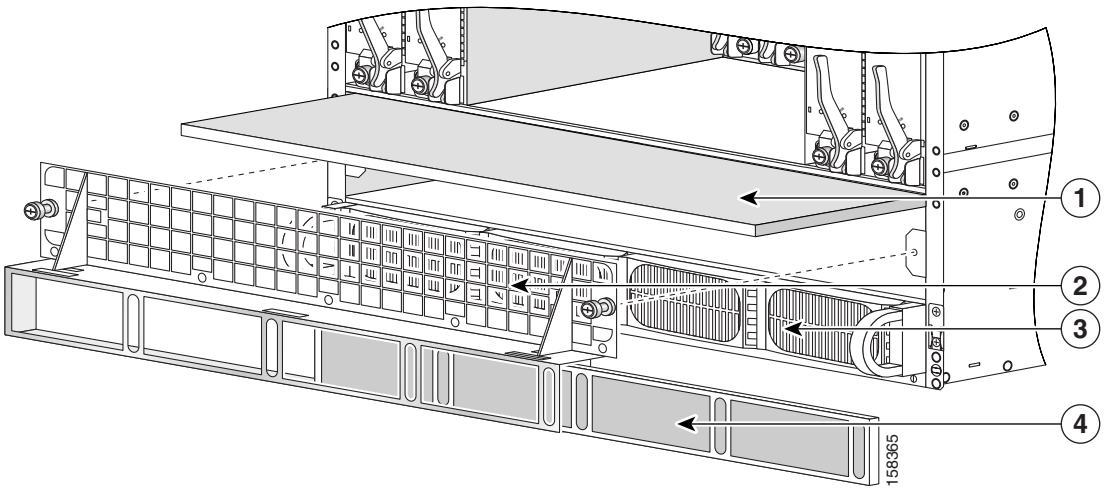
Note Each DC power supply weighs 4.5 lb (2 kg).

Figure 2-12 Installing DC Power Supplies



Step 14 Install the air filter (see Figure 2-13). For the procedure, see the "Installing the Chassis Air Filter" section on page 3-7.

Figure 2-13 Chassis Air Filter



1	Chassis air filter	**3**	Power tray and power supplies
2	Air intake grille	**4**	Power tray air filter

Step 15 Install the inlet grille. See the "Installing the Inlet Grille" section on page 5-2.

Removing a DC Power Shelf

This section describes how to remove a DC power shelf from the Cisco CRS-1 4-slot line card chassis. The DC power shelf is comprised of both the *DC power input shelf* and the *DC power input module (PIM)*. The DC power shelf encloses four power supplies and the power distribution connections and wiring blocks.

The DC power input shelf is in the front of the chassis; the power input module (PIM) is in the rear of the chassis.

Sequence of Tasks

The sequence of tasks required to remove the DC power shelf is as follows:

1. Bring down all power to the chassis.
2. Disconnect the input power cables.
3. Disconnect the grounding cable.
4. Remove the air intake (inlet) grille.
5. Remove all DC power supplies.
6. Remove the DC power input shelf.
7. Remove the DC power input module (PIM).

Prerequisites

Bring down the power to the Cisco CRS-1 4-slot line card chassis (as described in the steps below).

Required Tools and Equipment

You need the following tools and parts to perform this task:

- ESD-preventive wrist strap
- Medium flat-blade screwdriver
- Number 1 Phillips screwdriver
- Medium Phillips screwdriver
- 5 mm Allen wrench
- 10 mm hex socket wrench

Note This procedure assumes that the Cisco CRS-1 4-slot line card chassis is already mounted in a rack with sufficient room to access the sides and the bottom of the chassis.

Steps

To remove the DC power shelf, follow these steps:

Step 1 Attach the ESD-preventive wrist strap to your wrist and connect its leash to one of the ESD connection sockets on the front (PLIM) side of the chassis or a bare metal surface on the chassis.

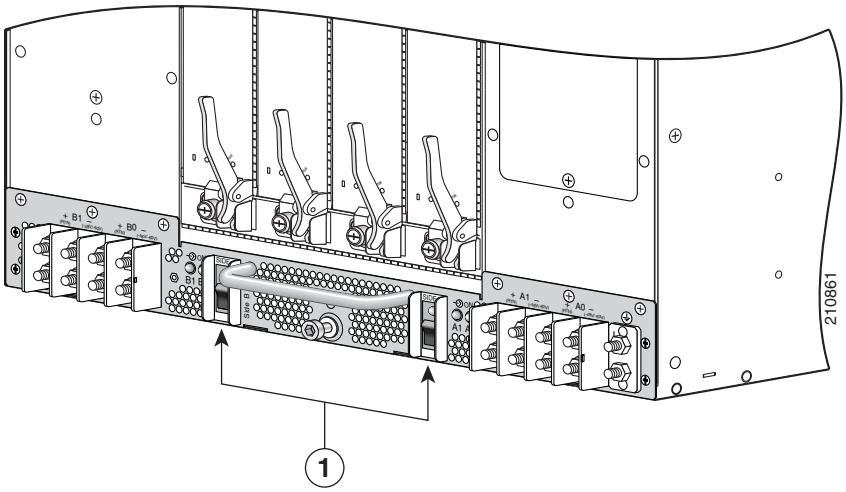
Bring Down All Power to the Chassis

Step 2 Power down the chassis:

a. Go to the rear of the chassis. On the PIM, toggle both power shelf enable switches to OFF (see Figure 2-14).

Now the system's boards and fans have no power.

Figure 2-14 DC Power Shelf Enable Switches



1	DC power shelf enable switches

b. Unplug the DC power supplies.

c. Disconnect input power from the customer source.

Step 3 Remove both wiring block covers (see Figure 2-15).

a. Use a number 1 Phillips screwdriver to loosen the capture screw.

b. Snap off the cover over the wiring block.

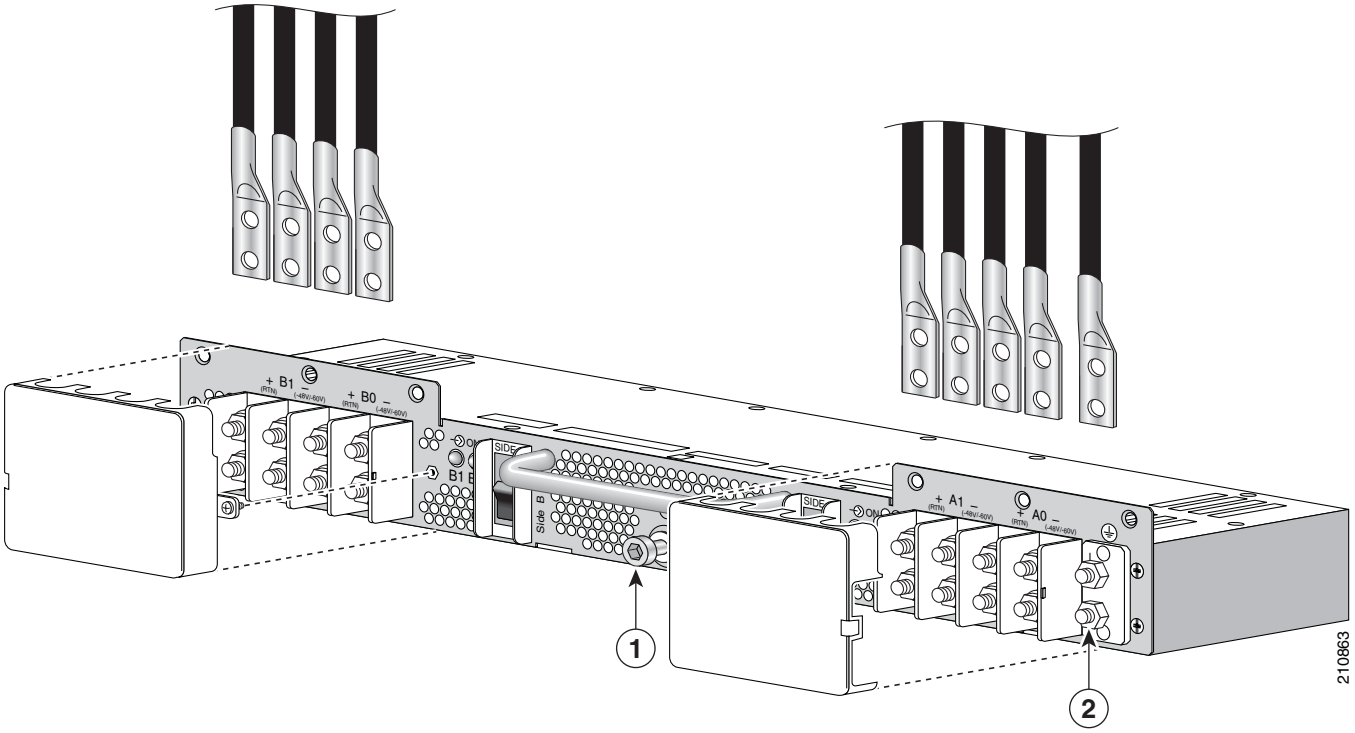
Disconnect the Input Power Cables and Grounding Cable

Step 4 Use a 10 mm hex socket wrench to disconnect the DC input power cables.

Disconnect the four 60A DC cables (two cables per input) on the left from one wiring block, and the four 60A DC cables on the right from the other wiring block (see Figure 2-15).

Step 5 Use a 10 mm hex socket wrench to disconnect the grounding cable (see Figure 2-15).

Figure 2-15 Removing Wiring Block Covers and DC Input Power Cables



1	Power shelf coupling screw	**2**	Grounding lug nuts

Step 6 With a 5 mm Allen wrench, loosen the power shelf coupling screw (see item 2 in Figure 2-15).

This will allow you to remove the DC power input shelf from the chassis (as described below).

Step 7 Go to the front of the chassis. Remove the inlet grille. For the procedure, see the "Removing the Inlet Grille" section on page 5-3.

Step 8 Remove the four DC power supplies. For the procedure, see the "Removing a Power Supply" section on page 2-28.

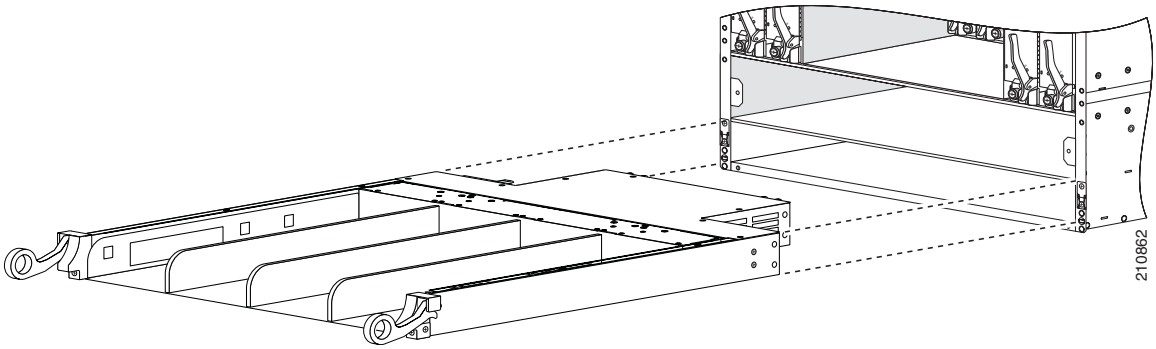
Remove the DC Power Input Shelf

Step 9 While still in the front of the chassis, you can now remove the DC power input shelf. To remove the DC power input shelf, follow these steps:

Caution An empty DC power input shelf weighs approximately 15.5 lb (7 kg).
To prevent injury when lifting the shelf, keep your back straight and lift with your legs, not your back. Avoid sudden twists or lateral moves.

a. To unlock the power input shelf, pull the lever handles down (see Figure 2-16).

Figure 2-16 Removing the DC Power Input Shelf



b. Holding the DC power input shelf underneath with one hand and steadying it with the other, lift the DC power input shelf up and slide it part way out of the power shelf slot.

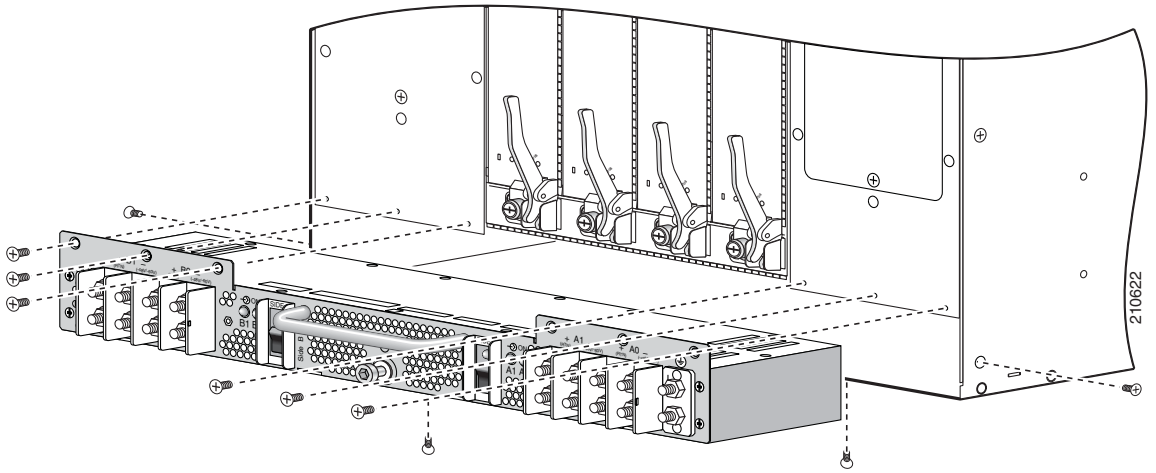
c. Slide the DC power input shelf fully out of the chassis. Set the power input shelf carefully aside.

Remove the DC Power Input Module (PIM)

Step 10 Go to the rear of the chassis. Remove the DC power input module (PIM).

a. With a No. 2 Phillips screwdriver, remove the first set of eight screws—six screws in the front of the chassis, two on the outside right and left sides of the chassis (see Figure 2-17).

Figure 2-17 Removing the DC Power Input Module (PIM)



b. Remove the additional two screws underneath the chassis (one on the left side, one on the right side) (see Figure 2-17).

c. With one hand gripping the handle and one hand underneath the module, carefully remove the PIM from the chassis; then set it aside.

Installing an AC Power Shelf

This section describes how to install an AC power shelf in the Cisco CRS-1 4-slot line card chassis. The power shelf encloses four power supplies and the power distribution connections and wiring. The AC power shelf is installed in the front (PLIM) side of the chassis.

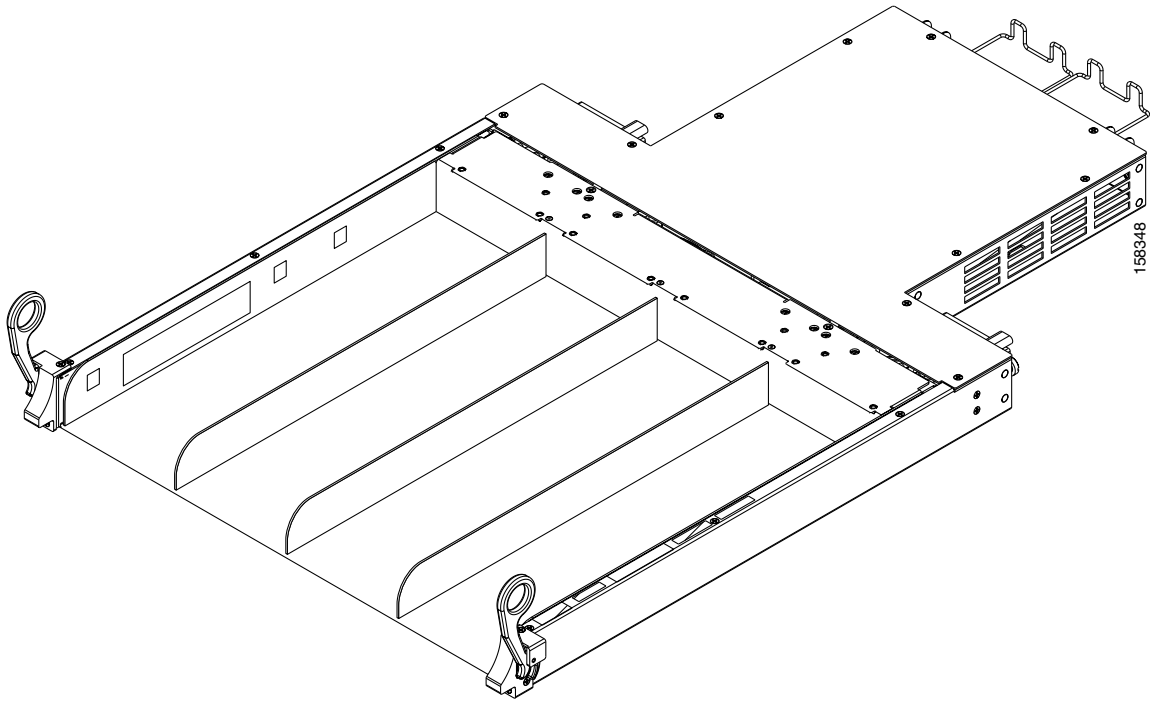
The AC-powered chassis contains a single AC power shelf containing four AC power supplies. Each AC power supply converts input AC power to the -54 VDC used by the Cisco CRS-1 4-slot line card chassis.

The AC power shelf is configured for single-phase AC power supply wiring(two wires + ground), and is safety-rated at 110 to 240V VAC nominal, 50 to 60 Hz (4x) 11A.

For additional power details, see *Cisco CRS-1 Carrier Routing System 4-Slot Line Card Chassis System Description*, or in this document, see Appendix A, "Cisco CRS-1 4-Slot Line Card Chassis System Specifications."

For complete information on regulatory compliance and safety, see *Cisco CRS-1 Carrier Routing System Regulatory Compliance and Safety Information*.

Figure 2-18 AC Power Shelf



Prerequisites

Remove the air intake grille from the bottom of the chassis.

Required Tools and Equipment

You need the following tools and parts to perform this task:

- ESD-preventive wrist strap
- Medium flat-blade screwdriver
- AC Power shelf (Cisco product number: CRS-4-AC-SHELF)

Steps

To install an AC power shelf, use Figure 2-18 as a reference and follow these steps:

Step 1 Attach the ESD-preventive wrist strap to your wrist and connect its leash to one of the ESD connection sockets on the front (SFC) side of the chassis or a bare metal surface on the chassis.

Step 2 Remove the air intake grille from the bottom of the chassis.

Step 3 Holding the AC power shelf underneath with one hand and steadying it with the other, lift the shelf up and slide it partway into the power shelf slot on the front (PLIM) side of the chassis. Be sure to center the shelf in the slot when you slide it in.

Caution An empty AC power shelf weighs approximately 7.0 lb (3.2 kg). To prevent injury when lifting the shelf, keep your back straight and lift with your legs, not your back. Avoid sudden twists or lateral moves.

Step 4 Slide the AC power shelf fully into the chassis. Be sure that the lever handles are aligned with the lever handle catches on the chassis casing.

Step 5 Lift the lever handles up to lock the tray into position.

Step 6 Use the flat-blade screwdriver to turn the two captive screws that connect the rear of the chassis to the power shelf, and tighten them fully.

Caution Be sure to attach the plugs carefully; incorrectly attached plugs can damage the chassis.

What to Do Next

After performing this task, install the power supplies (see the "Installing a Power Supply" section on page 2-25), and replace any chassis cosmetic cover plates.

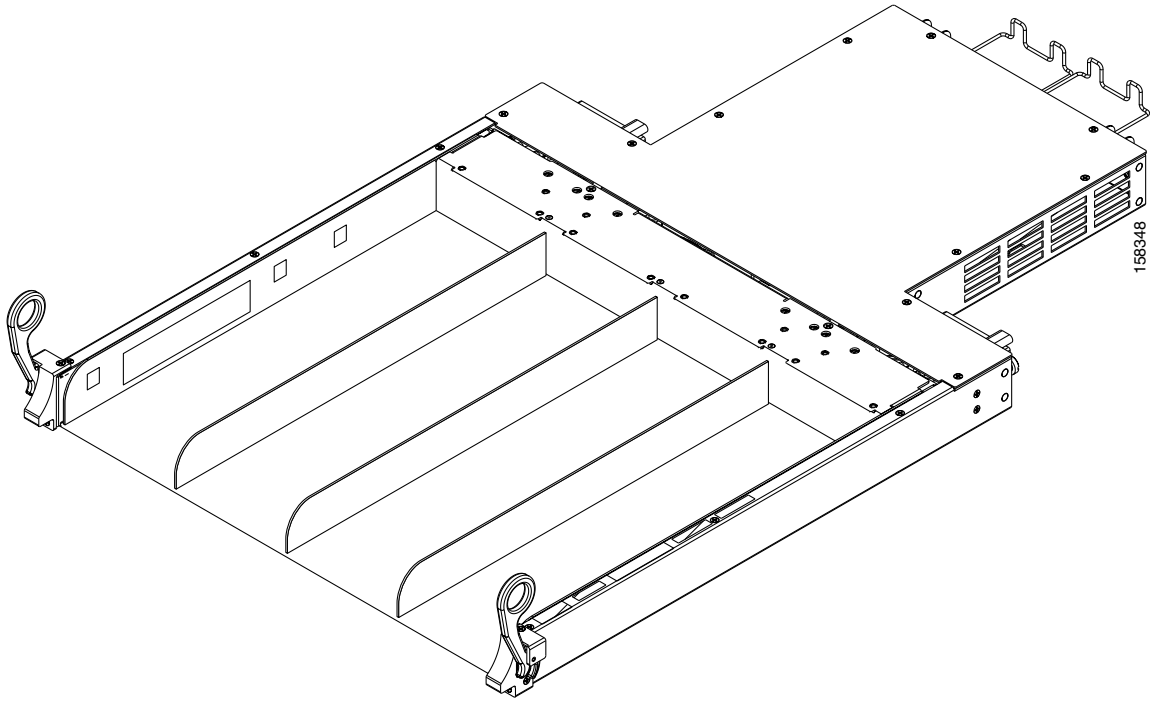
Removing an AC Power Shelf

This section describes how to remove an AC power shelf from the Cisco CRS-1 4-slot line card chassis. The AC power shelf encloses four power supplies and the power distribution connections and wiring. The AC power shelf is installed in the front (PLIM) side of the chassis. For more details on the power

systems see the "About Installing and Removing the Power Components" section on page 2-1. For complete information on regulatory compliance and safety, see *Cisco CRS-1 Carrier Routing System Regulatory Compliance and Safety Information*.

Caution Prior to removing the AC power shelf, to reduce the risk of damage, ensure that the rear panel fasteners are disengaged, the input power cables are disconnected, and the air intake (inlet) grille is removed.

Figure 2-19 AC Power Shelf



Prerequisites

Before performing this task, you must first remove the air intake grille from the bottom of the chassis, power down the chassis (see the "Powering the Chassis Up or Down" section on page 2-4), and detach the power cords.

Required Tools and Equipment

You need the following tools to perform this task:

- ESD-preventive wrist strap
- Medium flat-blade screwdriver

Steps

To remove an AC power shelf, follow these steps:

Step 1 Attach the ESD-preventive wrist strap to your wrist and connect its leash to one of the ESD connection sockets on the front (PLIM) side of the chassis or a bare metal surface on the chassis.

Step 2 Remove all four power supplies from the shelf you are removing. (See the "Removing a Power Supply" section on page 2-28.)

Step 3 Remove the power cables from the power from the four power inlets.

Step 4 While facing the rear (SFC) side of the chassis, use the screwdriver to loosen the two captive screws that connect the rear of the chassis to the power shelf by turning them counterclockwise.

Step 5 Pull the lever handles down with both hands and slide the AC power shelf partway from the slot in the chassis.

Caution An empty AC power shelf weighs approximately 7.0 lb (3.2 kg). To prevent injury when lifting the shelf, keep your back straight and lift with your legs, not your back. Avoid sudden twists or lateral moves.

Step 6 Placing one hand underneath the AC power shelf and pulling on it and steadying it with the other hand, slide the shelf completely from the chassis. (If attached, be sure to thread the power cable through the chassis carefully.)

Step 7 Set the AC power shelf carefully aside.

What to Do Next

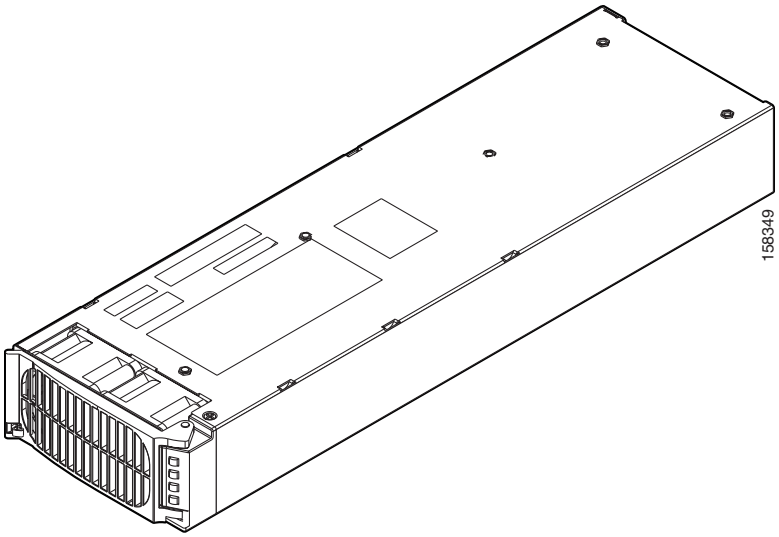
After performing this task, you may install a replacement power shelf (see the "Installing an AC Power Shelf" section on page 2-22), install the power supplies (see the "Installing a Power Supply" section on page 2-25), and replace any front chassis cosmetic covers.

Installing a Power Supply

This section describes how to install an AC or DC power supply in the Cisco CRS-1 4-slot power shelf. The AC power supply converts facility AC power into the DC power necessary to power the cards and modules in the chassis. Each AC and DC power supply has its own pair of cooling fans, which draws air through the power supply.

For complete information on regulatory compliance and safety, see *Cisco CRS-1 Carrier Routing System Regulatory Compliance and Safety Information*.

Figure 2-20 Power Supply



Prerequisites

Before performing this task, make sure that the power shelf has been installed (see the "Installing an AC Power Shelf" section on page 2-22 or the "Installing a DC Power Shelf" section on page 2-11); remove any cosmetic covers.

Required Tools and Equipment

You need the following tools and part to perform this task:

- ESD-preventive wrist strap
- Power supply

Steps

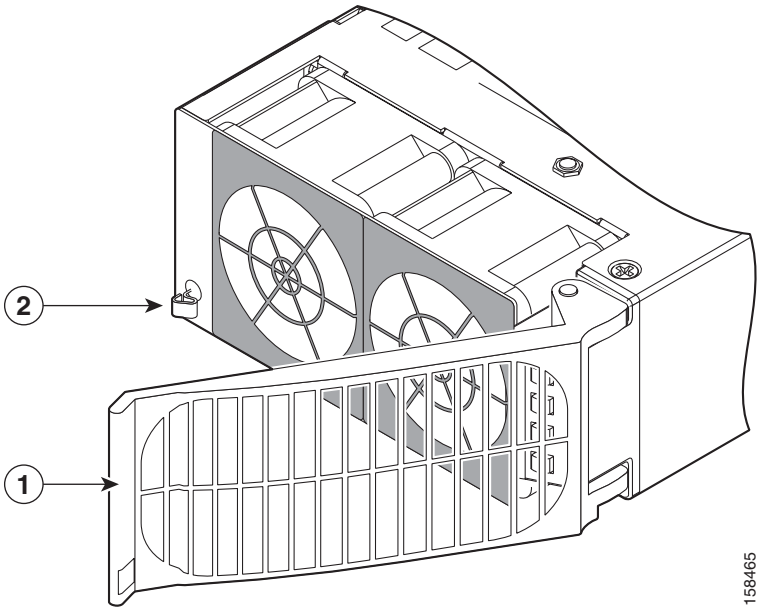
To install a power supply, follow these steps:

Step 1 Attach the ESD-preventive wrist strap to your wrist and connect its leash to one of the ESD connection sockets on the front (PLIM) side of the chassis or a bare metal surface on the chassis.

Step 2 Using two hands to support and guide the power supply, slide it partway into the power tray on the front (PLIM) side of the chassis.

Step 3 Make sure that the power supply door grille is in the open position (see Figure 2-21).

Figure 2-21 Power Supply Door Grille in Open Position



1	Power supply door grille	**2**	Power supply door latch

Step 4 Slide the power supply into the power shelf until the connector on the back of the module meets the connector on the backplane of the AC or DC power shelf.

Caution A power supply weighs about 4.5 lb (2 kg). You should use two hands when handling a module.

Step 5 Close the power supply door grille to seat the power supply fully against the AC or DC power shelf. Make sure that the power supply door grille latch clicks into place.

Tip The power supply door can be latched while it is still outside of the power shelf; if that occurs, the power supply will not function according to specification. To ensure proper functionality, the power supply door must be latched *only* after the power supply is fully engaged into the AC power shelf.

Caution To prevent damage to the AC or DC power shelf-to-power supply connections, do not use excessive force when seating a power supply to its power shelf.

What to Do Next

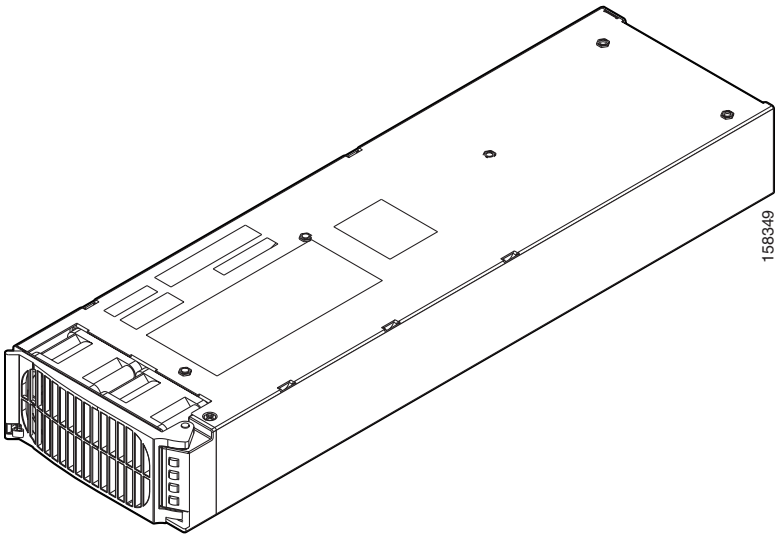
After performing this task, you may connect the power shelf to the power source (see the "About Installing and Removing the Power Components" section on page 2-1, replace any front cosmetic covers, and power up the chassis (see the "Powering the Chassis Up or Down" section on page 2-4).

Removing a Power Supply

This section describes how to remove a power supply in the Cisco CRS-1 4-slot line card chassis. The power supplies can be an AC or DC power supplies (however, mixed types are not permitted). The AC power supply converts facility AC power into the DC power necessary to power the cards and modules in the chassis. Each AC power supply has its own pair of cooling fans, which draws air through the power supply.

For complete information on regulatory compliance and safety, see *Cisco CRS-1 Carrier Routing System Regulatory Compliance and Safety Information*.

Figure 2-22 Power Supply on the Cisco CRS-1 4-Slot Router



Prerequisites

Before operating the power shelf ejectors and removing the power shelf, take the following precautions:

- For an AC power shelf, ensure that the rear panel fasteners are disengaged.
- For a DC power shelf, unlock the power input shelf by pulling the lever handles down.
- Disconnect the input power cables.
- Remove the air intake (inlet) grille.

Required Tools and Equipment

You need the following tools to perform this task:

- ESD-preventive wrist strap

Steps

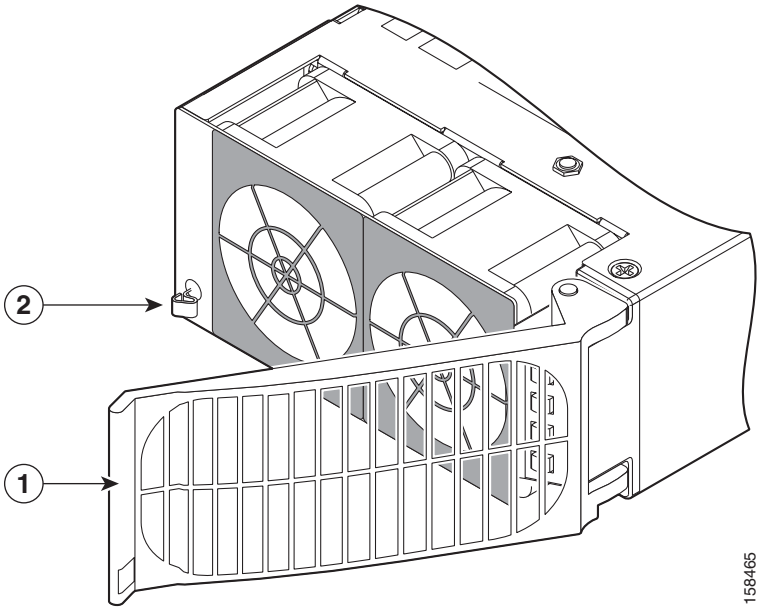
To remove a power supply, follow these steps:

Step 1 Attach the ESD-preventive wrist strap to your wrist and connect its leash to one of the ESD connection sockets on the front (PLIM) side of the chassis or a bare metal surface on the chassis.

Step 2 To unseat the power supply from the power shelf connector, unlatch the power supply's door grille latch and open it completely.

Note The power supply fans may continue to turn at high speed for a few seconds after they are unseated from the power shelf.

Figure 2-23 Power Supply Door Grille and Latch



1	Power supply door grille	**2**	Power supply door latch

Step 3 Grasp the power supply door grille and gently pull the power supply halfway from the bay.

Caution Take care when handling a power supply that has recently been in use; it can be hot to the touch.

Note A power supply weighs about 4.6 lb (2.1 kg). You should use two hands when handling a power supply.

Step 4 Use your free hand to support the power supply while you slide the power supply completely from the bay, then set the power supply safely aside.

What to Do Next

After performing this task, you may install a new power supply, if needed (see the "Installing a Power Supply" section on page 2-25), and replace any front cosmetic covers.

CHAPTER 3

Installing and Removing Air Circulation Components

This chapter provides instructions on how to install and replace the Cisco CRS-1 Carrier Routing System 4-Slot Line Card Chassis air circulation components.

This chapter presents the following topics:

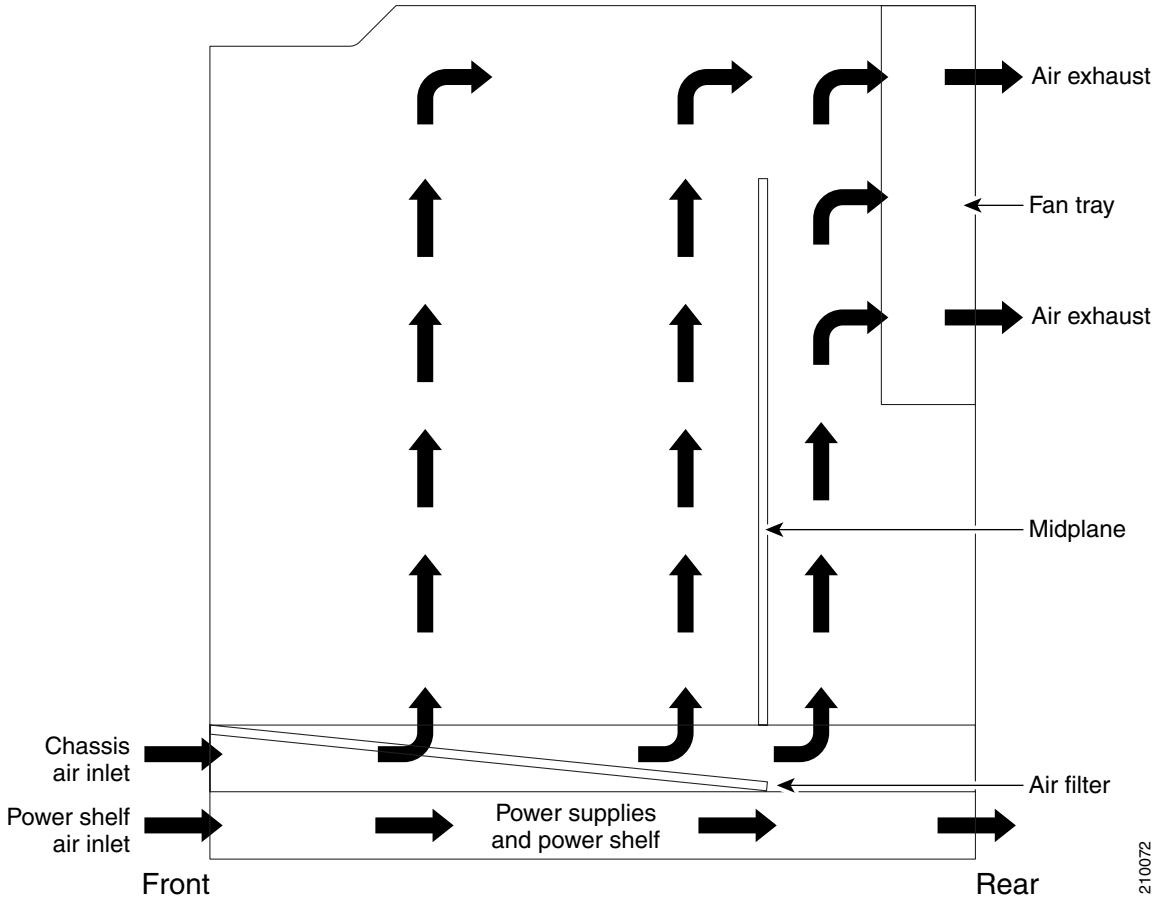
- About Line Card Chassis Airflow
- How to Install or Remove Air Circulation Components

About Line Card Chassis Airflow

The Cisco CRS-1 4-slot line card chassis has a single fan tray containing four fans that cool the chassis card cage. Cool air flows in at the bottom front of the chassis and flows through the chassis card cage and through the fans in the fan tray before being exhausted through the top rear of the chassis (see Figure 3-1).

In addition, each power module at the bottom of the chassis has self-contained fans that pull in cool air from the front of the chassis and exhaust warm air out the rear. There is parallel path for airflow through the fabric cards.

Figure 3-1 Airflow Through the Cisco CRS-1 4-Slot Line Card Chassis

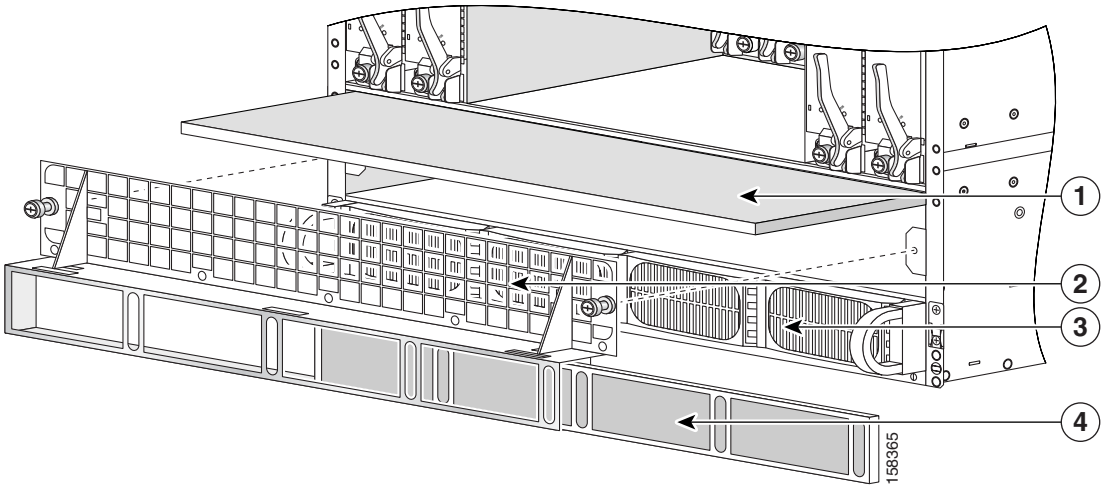


A replaceable air filter is located inside the chassis below the PLIM card cage at an angle. In addition, there is a removable air filter on the front of the power tray air intake grille on the front (PLIM) side of the chassis. (See Figure 3-2.)

Air Filter Replacement Frequency Recommendation

How often the air filters should be replaced depends on the facility environment. In a dirty environment, or when you start getting frequent temperature alarms, you should always check the intake grilles for debris, and then check the air filters to see if they need to be replaced.

Figure 3-2 System Air Filters



1	Chassis air filter	**3**	Power tray and power supplies
2	Air intake grille	**4**	Power tray air filter

Note We recommend that you check the air filters once a month. Replace a filter when you notice a significant amount of dust.

Caution To remain NEBS compliant, the chassis air filter can be replaced only when the fan trays are not running.

The Cisco CRS-1 4-slot line card chassis airflow volumes are as follows:

- Chassis airflow: Up to 880 cubic feet (24,919 liters) per minute
- Power system airflow: Up to 60 cubic feet (1699 liters) per minute

How to Install or Remove Air Circulation Components

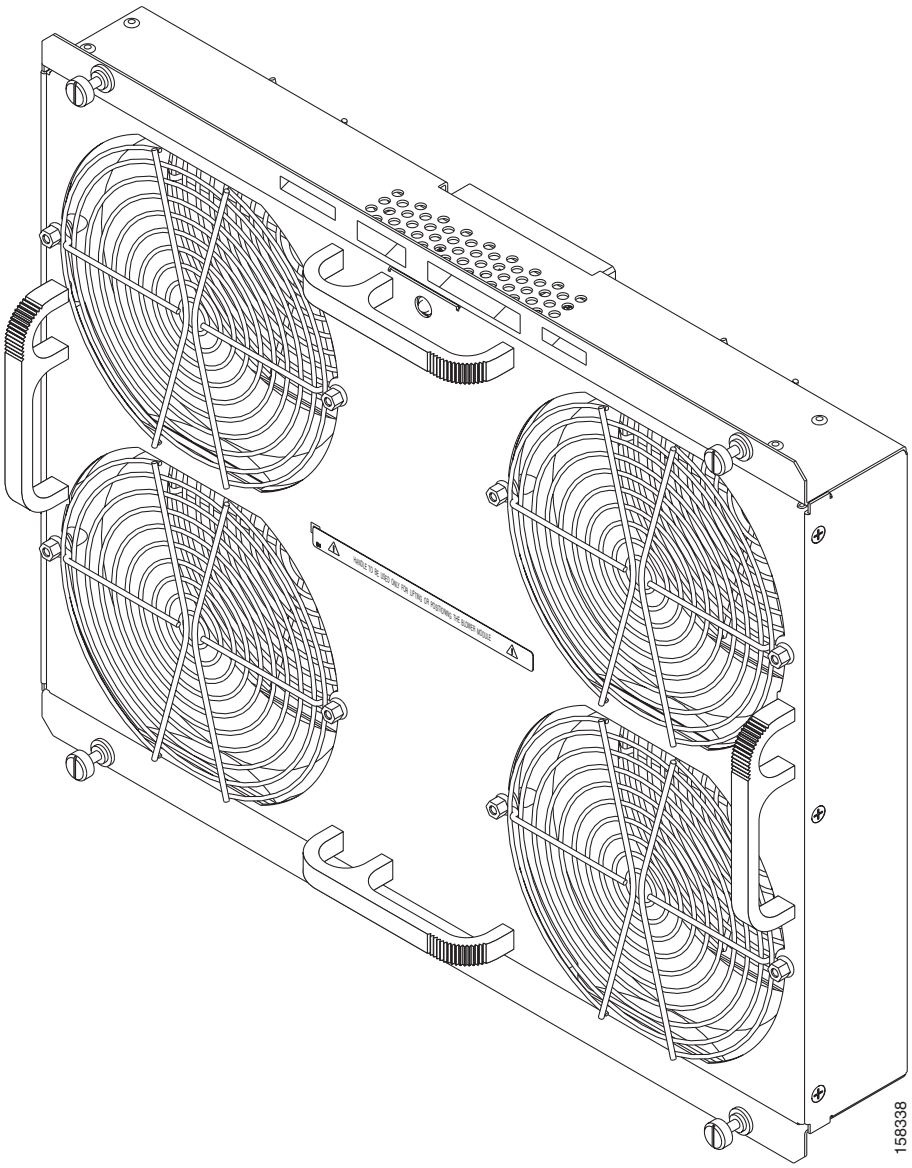
This section contains the following procedures:

- Installing a Fan Tray
- Removing a Fan Tray
- Installing the Chassis Air Filter
- Removing the Chassis Air Filter
- Installing a Power Tray Air Filter
- Removing a Power Tray Air Filter

Installing a Fan Tray

This section describes how to install a fan tray in the Cisco CRS-1 4-slot line card chassis. For information on the chassis airflow and circulation, see the "About Line Card Chassis Airflow" section on page 3-1. The fan tray installs into the rear (SFC) side of the chassis (see Figure 3-3). For complete information on regulatory compliance and safety, see *Cisco CRS-1 Carrier Routing System Regulatory Compliance and Safety Information*.

Figure 3-3 Fan Tray



Prerequisites

No prerequisites exist for this task.

Required Tools and Equipment

You need the following tools and part to perform this task:

- ESD-preventive wrist strap
- Large flat-blade screwdriver
- Fan tray (Cisco product number CRS-4-FAN-TR=)

Steps

To install a fan tray, follow these steps:

Step 1 Attach the ESD-preventive wrist strap to your wrist and connect its leash to one of the ESD connection sockets on the rear (SFC) side of the chassis or a bare metal surface on the chassis.

Step 2 Holding the fan tray by the handles, position it in front of the fan tray bay on the upper rear (SFC) side of the chassis. Slide the tray partway into its slot.

Caution A fan tray weighs approximately 16 lb (7 kg.). Use two hands when handling a fan tray.

Caution Do not set the fan tray down on the connector; doing so could damage it.

Step 3 Slide the fan tray all the way in. Press it firmly into the chassis so that the connector on the back of the fan tray is seated firmly against the connector on the interior of the chassis.

Caution To prevent damage to the chassis connector, do not use excessive force when inserting a fan tray into its bay.

Step 4 Using the screwdriver, tighten the four captive screws (one for each corner).

Note All electrical and control line connections are made automatically when the connectors mate.

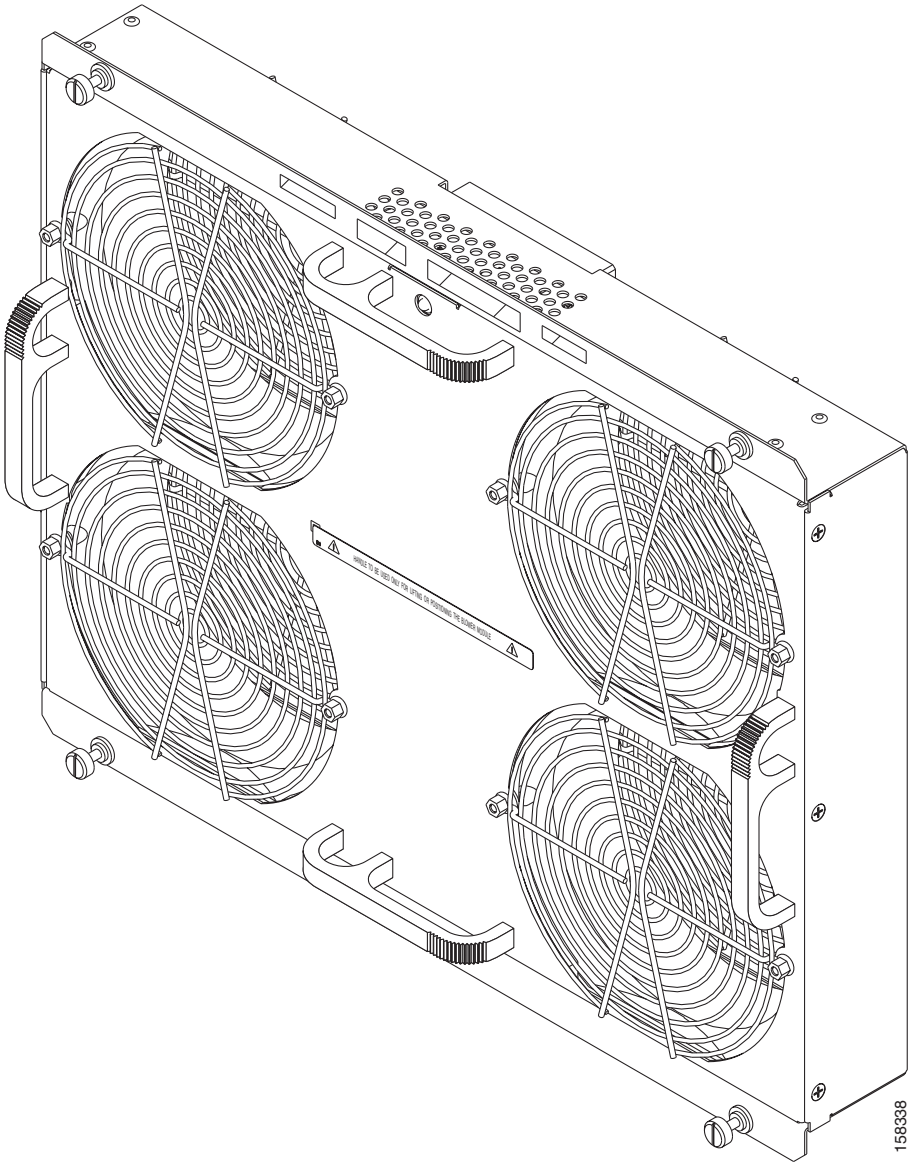
Removing a Fan Tray

This section describes how to remove a fan tray from the Cisco CRS-1 4-slot line card chassis. For information on the chassis airflow and circulation, see the "About Line Card Chassis Airflow" section on page 3-1.

The fan tray installs into the rear (SFC) side of the chassis (see Figure 3-4). For complete information on regulatory compliance and safety, see *Cisco CRS-1 Carrier Routing System Regulatory Compliance and Safety Information*.

Caution The chassis automatically powers down if the fan tray is unseated from its connector for more than one minute. If you plan on hot swapping the fan tray, have the replacement fan tray readily available and be sure to insert it and seat it against its connector in less than one minute. Familiarize yourself with the procedure in the "Installing a Fan Tray" section on page 3-4 before attempting to hot swap the fan tray.

Figure 3-4 Fan Tray



Prerequisites

No prerequisites exist for this task.

Required Tools and Equipment

You need the following tools to perform this task:

- ESD-preventive wrist strap
- Large flat-blade screwdriver

Steps

To remove a fan tray, follow these steps:

Step 1 Attach the ESD-preventive wrist strap to your wrist and connect its leash to one of the ESD connection sockets on the rear (SFC) side of the chassis or a bare metal surface on the chassis.

Step 2 Using the large flat-blade screwdriver, loosen the four captive screws on the fan tray (one for each corner).

Caution A fan tray weighs approximately 16 lb (7 kg.). Use two hands when handling a fan tray.

Step 3 Grasp the fan tray by the handles and pull it gently straight out to disconnect the fan tray from the connector mounted on the back of the fan tray.

Step 4 Remove the fan tray completely from the fan tray bay. Set the fan tray safely aside.

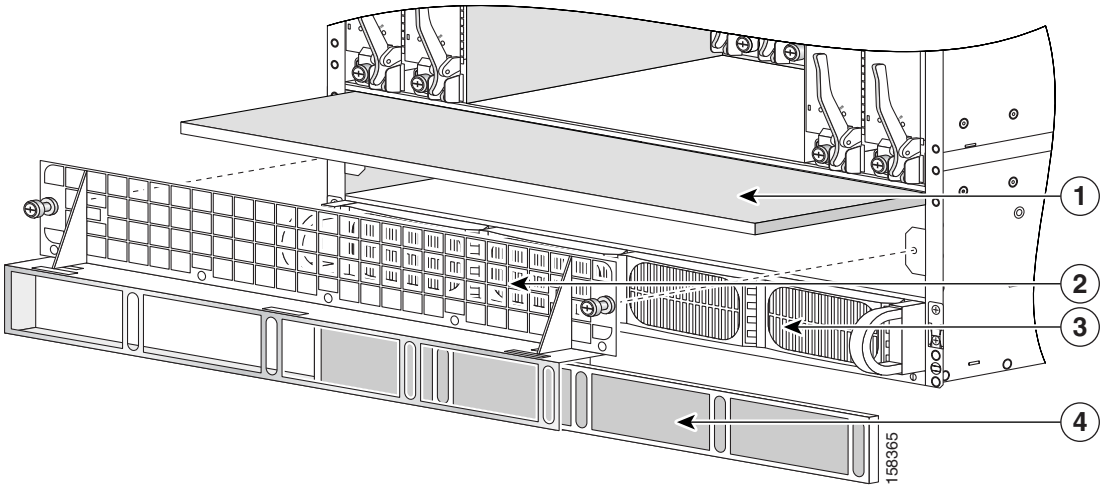
Caution Do not set the fan tray down on the connector; doing so could damage it.

Installing the Chassis Air Filter

This section describes how to install the air filter in the Cisco CRS-1 4-slot line card chassis. For further information, see the "About Line Card Chassis Airflow" section on page 3-1. For complete information on regulatory compliance and safety, see *Cisco CRS-1 Carrier Routing System Regulatory Compliance and Safety Information*.

The Cisco CRS-1 4-slot line card chassis has a serviceable air filter that plugs into the front (PLIM) side of the chassis (see item number 1 in Figure 3-5) just inside the air intake slot. During operation, the air filter access is hidden by the lower chassis grille.

Figure 3-5 Chassis Air Filter



1	Chassis air filter	**3**	Power tray and power supplies
2	Air intake grille	**4**	Power tray air filter

Prerequisites

Before performing this task, you must first remove any chassis front cosmetic covers, the lower chassis air intake grille and power tray air filter cover (see the "Installing a Power Tray Air Filter" section on page 3-10).

Caution Never operate the Cisco CRS-1 4-slot line card chassis without an air filter. Doing so can damage the hardware.

Required Tools and Equipment

You need the following part to perform this task:

- Chassis air filter (Cisco product number: CRS-4-FILTER=)
- Medium flat-blade screwdriver

Steps

To install the chassis air filter, follow these steps:

Step 1 If an air filter is currently in the slot, remove it.

Step 2 Slide the new air filter into the air filter slot until it is seated fully within the slot.

Step 3 Replace the lower chassis grille:

a. Position the grille in front of the air intake slot on the lower front side of the chassis and press it gently into place. Make sure that you align the guide pins on the lower corners of the grille with the guide pin holes on the chassis.

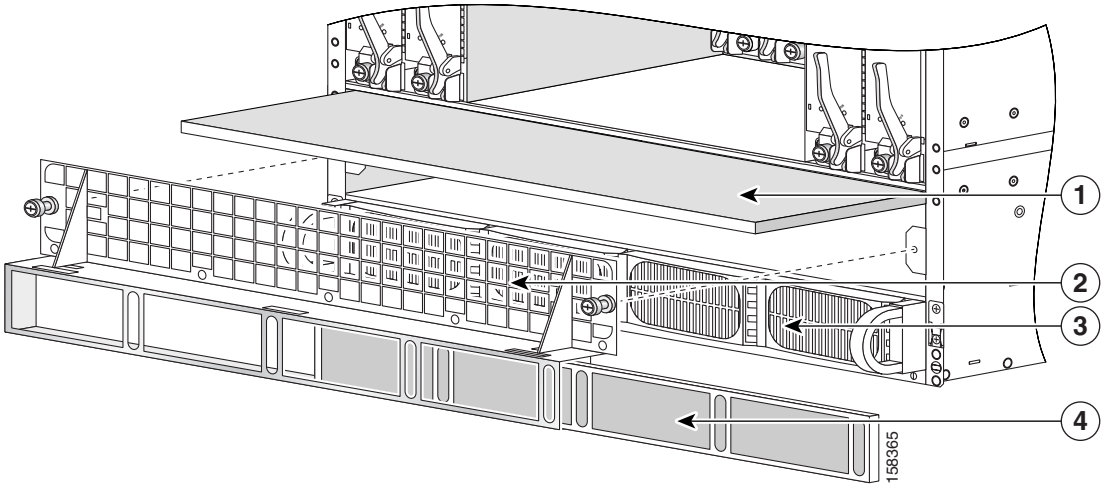
b. Use a medium flat-blade screwdriver to tighten the two captive screws (on for each side) that hold the grille to the front of the chassis.

Removing the Chassis Air Filter

This section describes how to remove the air filter in the Cisco CRS-1 4-slot line card chassis. For further information, see the "About Line Card Chassis Airflow" section on page 3-1. For complete information on regulatory compliance and safety, see *Cisco CRS-1 Carrier Routing System Regulatory Compliance and Safety Information*.

The chassis has a serviceable air filter that plugs into the front (PLIM) side of the chassis (see item number 1 in Figure 3-6) just inside the air intake slot. During operation, the air filter access is hidden by the lower chassis grille.

Figure 3-6 Chassis Air Filter



1	Chassis air filter	**3**	Power tray and power supplies
2	Air intake grille	**4**	Power tray air filter

Caution To remain NEBS compliant, the chassis air filter can be replaced only when the fan tray is not running. The chassis powers down one minute after the fan tray is removed, so we recommend using two people to replace the chassis air filter at NEBS-compliant sites. Familiarize yourself with the steps in the "Installing a Fan Tray" section on page 3-4 and the "Removing a Fan Tray" section on page 3-5 prior to replacing the chassis air filter.

Prerequisites

Before performing this task, you must first remove the lower chassis grille and power tray air filter cover (see the "Installing a Power Tray Air Filter" section on page 3-10).

Caution Never operate the line card chassis without an air filter. Doing so can damage the hardware.

Required Tools and Equipment

You need the following tools to perform this task:

- ESD-preventive wrist straps
- Large flat-blade screwdriver

Steps

To remove the chassis air filter, follow these steps:

Step 1 Attach the ESD-preventive wrist strap to your wrist and connect its leash to one of the ESD connection sockets on the front (PLIM) side of the chassis or a bare metal surface on the chassis.

Step 2 Unscrew the two captive screws that connect the air intake grille to the front (PLIM) side of the chassis.

Step 3 Set the air intake grille carefully aside.

Step 4 Grasp the air filter and carefully slide it from the slot. Set the air filter carefully aside.

Step 5 Install the replacement air filter (if necessary). See the "Installing the Chassis Air Filter" section on page 3-7.

What to Do Next

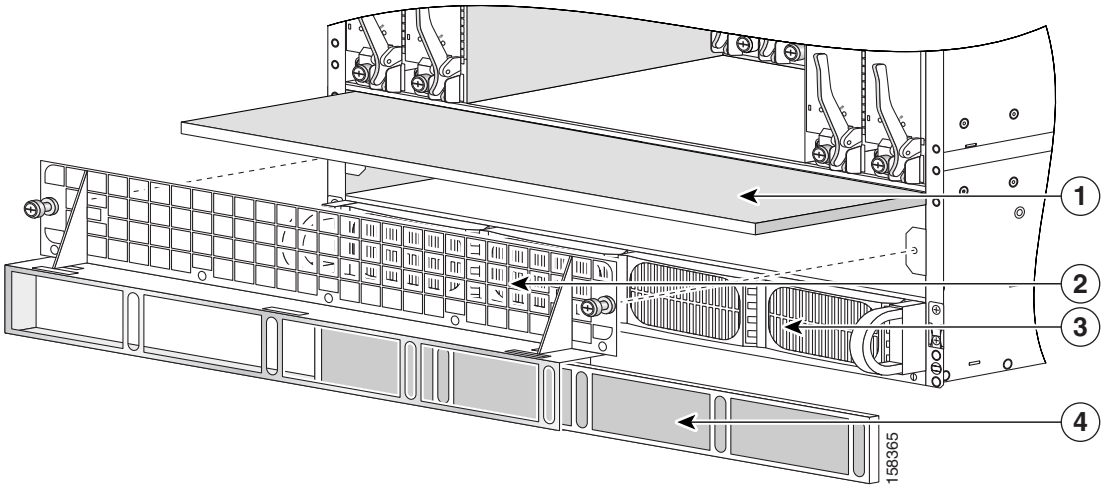
After performing this task, replace the lower chassis grille (see the "Installing a Power Tray Air Filter" section on page 3-10) and the front cover plates.

Installing a Power Tray Air Filter

This section describes how to install a power tray air filter for the Cisco CRS-1 4-slot line card chassis. For further information, see the "About Line Card Chassis Airflow" section on page 3-1. For complete information on regulatory compliance and safety, see *Cisco CRS-1 Carrier Routing System Regulatory Compliance and Safety Information*.

The power tray has a serviceable air filter that is inserted into the lower chassis grille, just in front of the power tray (see item number 4 in Figure 3-7).

Figure 3-7 Power Tray Air Filter



1	Chassis air filter	**3**	Power tray and power modules
2	Air intake grille	**4**	Power tray air filter

Prerequisites

No prerequisites exist for this task.

Caution Never operate the line card chassis without an air filter. Doing so can damage the hardware.

Required Tools and Equipment

You need the following tools and part to perform this task:

- ESD-preventive wrist strap
- Medium flat-blade screwdriver
- Power tray air filter

Steps

To install a power tray air filter, follow these steps:

Step 1 Attach the ESD-preventive wrist strap to your wrist and connect its leash to one of the ESD connection sockets on the front (PLIM) side of the chassis or a bare metal surface on the chassis.

Step 2 Remove the lower chassis grille:

- Use the medium flat-blade screwdriver to loosen the two captive screws (one for each side) that hold the grille to the front of the chassis.
- Gently remove the grille from the chassis.

Step 3 Slide the air filter into the air filter slot on the grille (see Figure 3-7).

Step 4 Reinstall the lower chassis grille:

a. Position the grille in front of the air intake slot on the lower front side of the chassis and press it gently into place. Make sure that you align the guide pins on the lower corners of the grille with the guide pin holes on the chassis.

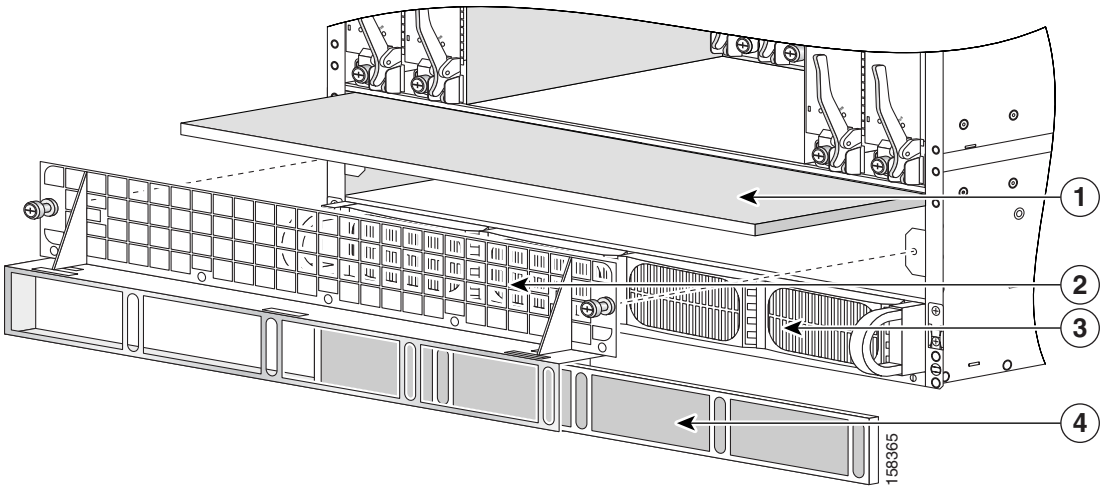
b. Use a medium flat-blade screwdriver to tighten the two captive screws (on for each side) that hold the grille to the front of the chassis.

Removing a Power Tray Air Filter

This section describes how to remove a power tray air filter. For further information, see the "About Line Card Chassis Airflow" section on page 3-1. For complete information on regulatory compliance and safety, see *Regulatory Compliance and Safety Information for the Cisco CRS-1 Carrier Routing System*.

The power tray has a serviceable air filter that is inserted into the lower chassis grille, just in front of the power tray (see item number 4 in Figure 3-8).

Figure 3-8 Power Tray Air Filter



1	Chassis air filter	**3**	Power tray and power modules
2	Air intake grille	**4**	Power tray air filter

Prerequisites

No prerequisites exist for this task.

Caution Never operate the line card chassis without an air filter. Doing so can result in damage to the hardware.

Required Tools and Equipment

You need the following tools to perform this task:

- ESD-preventive wrist strap
- Medium flat-blade screwdriver

Steps

To remove a power tray air filter, follow these steps:

Step 1 Attach the ESD-preventive wrist strap to your wrist and connect its leash to one of the ESD connection sockets on the front (PLIM) side of the chassis or a bare metal surface on the chassis.

Step 2 Remove the lower chassis grille (if necessary):

a. Use a medium flat-blade screwdriver to tighten the two captive screws (one for each side) that hold the grille to the front of the chassis.

b. Gently remove the grille from the chassis.

Step 3 Slide the air filter from the air filter slot on the grille (see Figure 3-8).

What to Do Next

After performing this task, you may install a new air filter (see the "Installing a Power Tray Air Filter" section on page 3-10).

CHAPTER 4

Installing and Removing SFCs, RPs, MSCs, PLIMs, and Associated Components

This chapter provides instructions on how to install and remove the Cisco CRS-1 Carrier Routing System 4-Slot Line Card Chassis switch fabric cards (SFCs), route processors (RPs), modular services cards (MSCs), physical layer interface modules (PLIMs), and the associated components.

This chapter presents the following topics:

- About Installing and Removing Cards and Associated Components
- How to Remove or Install an Impedance Carrier
- How to Remove or Install a Card Slide-Assistance Arm (Handle)
- How to Install or Remove a Pillow Block
- How to Install or Remove a Switch Fabric Card
- How to Install or Remove a Route Processor Card
- How to Install or Remove a Modular Services Card
- How to Install or Remove a Physical Layer Interface Module
- How to Install or Remove a PCMCIA Card
- How to Install or Remove a Small Form-Factor Pluggable (SFP) Module

About Installing and Removing Cards and Associated Components

This section contains some general information about installing and removing cards, PLIMs, and the associated components.

- Guidelines for Card Installation and Removal
- PCMCIA Cards
- Small Form-Factor Pluggable (SFP) Modules
- Cable Management Brackets

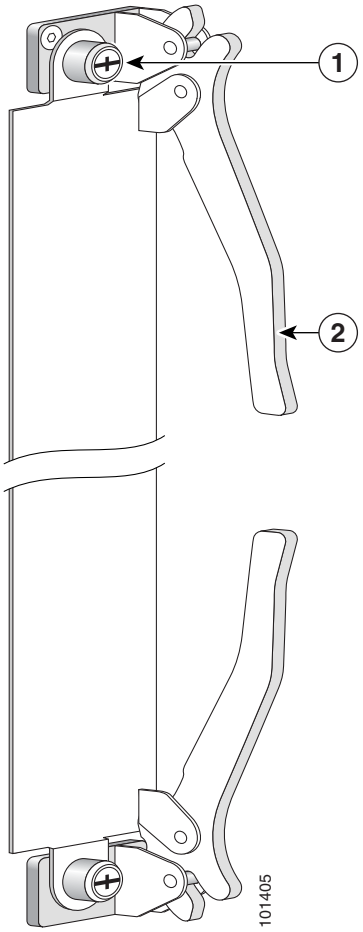
Guidelines for Card Installation and Removal

This section contains the general guidelines for card installation and removal.

Online insertion and removal (OIR) is supported, enabling you to remove and install cards while the Cisco CRS-1 4-slot line card chassis is operating. OIR is seamless to users on the network, maintains all routing information, and ensures session preservation. Notifying the software or resetting the power is not required. However, you have the option of using the **shutdown** command before removing a card.

The different cards in the line card chassis are all attached to the chassis itself using a pair of ejector levers and captive screws. The two ejector levers release the card from its midplane connector. The exact location of the ejector levers and captive screws varies slightly from card to card, but are in general in the same location: on the upper and bottom of the faceplate of the card. Figure 4-1 shows the location of the ejector levers and captive screws on an MSC.

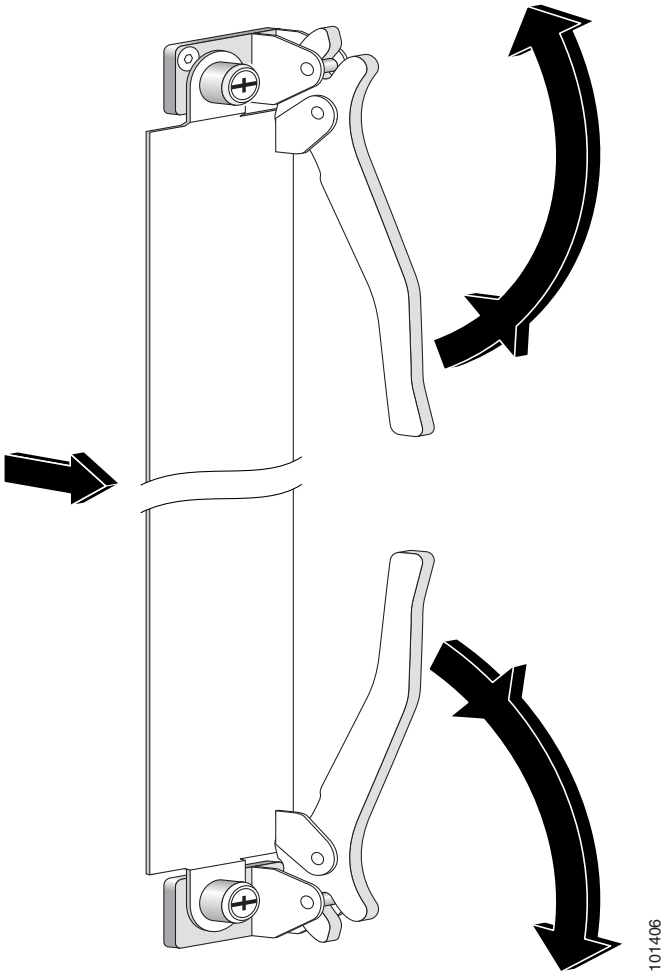
Figure 4-1 Ejector Levers and Captive Screws



1	Captive screw	**2**	Ejector lever

Figure 4-2 shows how to operate the ejector levers. Be sure to operate both levers simultaneously.

Figure 4-2 Operating Ejector Levers



Recommended Order for Installing Cards

Although it is not critical for you to install the cards in a certain order, following the card installation recommendations in this section will make your installation process easier. We recommend that you install cards in the Cisco CRS-1 4-slot chassis in the following order:

- Switch fabric cards (SFCs)

Caution Removing more than one switch fabric card at a time can misalign the chassis and may damage the card or chassis when reinserting the cards. Remove and reinsert only one card at a time.

- Route processors (RPs)
- Modular services cards (MSCs)
- Physical layer interface modules (PLIMs)

Note See the instructions in this chapter for details on how to install the individual cards.

Guidelines

When you install or remove cards on the Cisco CRS-1 4-slot line card chassis, follow these guidelines:

- Do not operate the Cisco CRS-1 4-slot line card chassis with any slots completely empty; doing so can lead to an airflow bypass condition that diverts airflow from slots containing heat-generating electronics. This situation can cause thermal alarms to occur at lower-than-expected ambient temperatures. To avoid airflow bypass, make sure that all slots are filled with their appropriate cards or impedance carriers. If you have to replace a card, we recommend leaving the card in place in the chassis until you are ready to install the new one.
- When you remove a card, always use the ejector levers to ensure that the connector pins disconnect from the midplane in the sequence expected by the router.
- To lessen the possibility of damaging the connectors on the chassis midplane, you should visually inspect the connector pins on the cards before you insert them into the chassis.

PCMCIA Cards

Optional and replaceable PCMCIA cards are available for the RP cards. The RP cards provide two PCMCIA flash slots, each card providing up to 1 GB of flash storage. One of the PCMCIA flash subsystems is accessible externally, is removable, and allows you to transfer system images and configurations by plugging in a PCMCIA flash card. The other subsystem is fixed to the RP, is not removable, and is used for permanent storage of configurations and system images.

Small Form-Factor Pluggable (SFP) Modules

The SFP module for the Cisco CRS-1 4-slot line card chassis uses the bale-clasp latch type.

Caution Protect the SFP modules by inserting clean dust covers into them after the cables are removed from them. Be sure to clean the optic surfaces of the fiber cables before you plug them back into the optical ports of another SFP module. Avoid getting dust and other contaminants into the optical ports of the SFP modules: The optics do not work correctly when obstructed with dust.

Note Shared port adapters (SPAs) and the 16-port OC-48c/STM-16c PLIM use SFP modules.

Cable Management Brackets

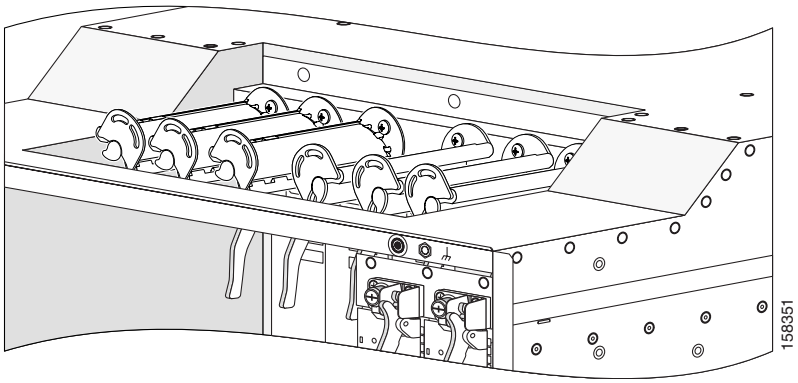
The Cisco CRS-1 4-slot line card chassis includes a cable management system that organizes the interface cables entering and exiting the different cards, keeping them out of the way and free of sharp bends.

Caution Excessive bending of interface cables can damage the cables.

The Cisco CRS-1 4-slot line card chassis arrives preinstalled with a horizontal cable management bracket on the front of the chassis; this bracket cannot be removed or replaced.

Figure 4-3 shows the chassis cable management bracket.

Figure 4-3 Cable Management Bracket



How to Remove or Install an Impedance Carrier

This section contains the following procedures:

- Removing an Impedance Carrier
- Installing an Impedance Carrier

When shipped, all slots in the chassis contain impedance carriers to help maintain chassis stiffness and ensure that the chassis is undamaged during shipment. Four different types of impedance carriers exist for the four different sizes of slots in the chassis (see Figure 4-4, Figure 4-5, Figure 4-6, and Figure 4-7).

Figure 4-4 Switch Fabric Slot Impedance Carrier

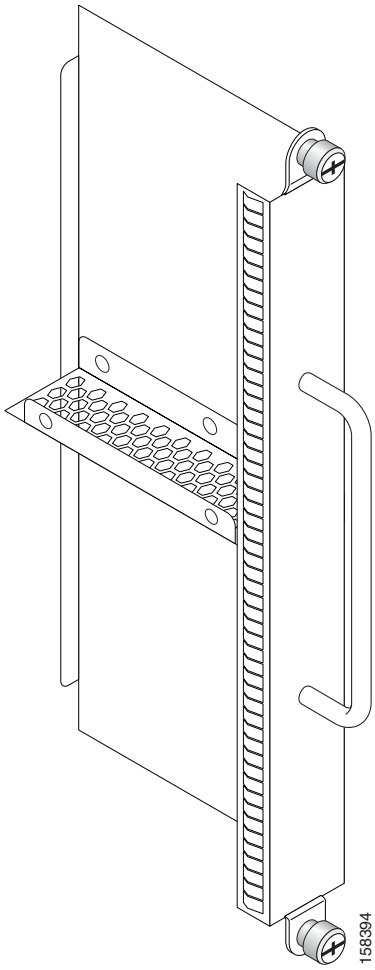


Figure 4-5 RP Slot Impedance Carrier

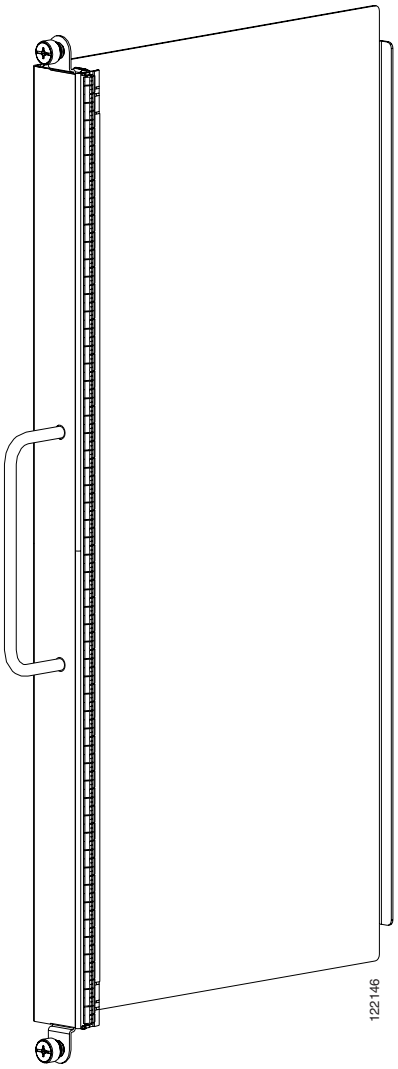


Figure 4-6 PLIM Slot Impedance Carrier

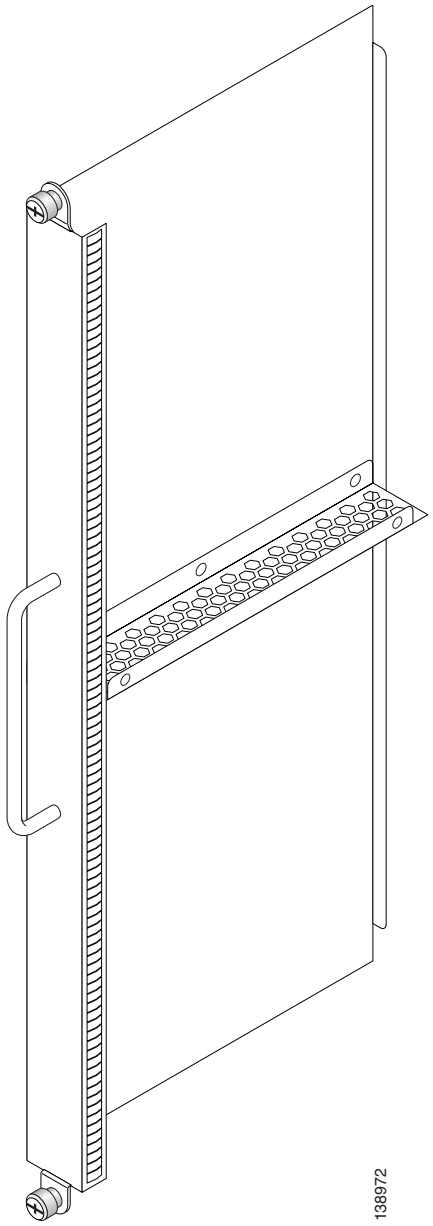
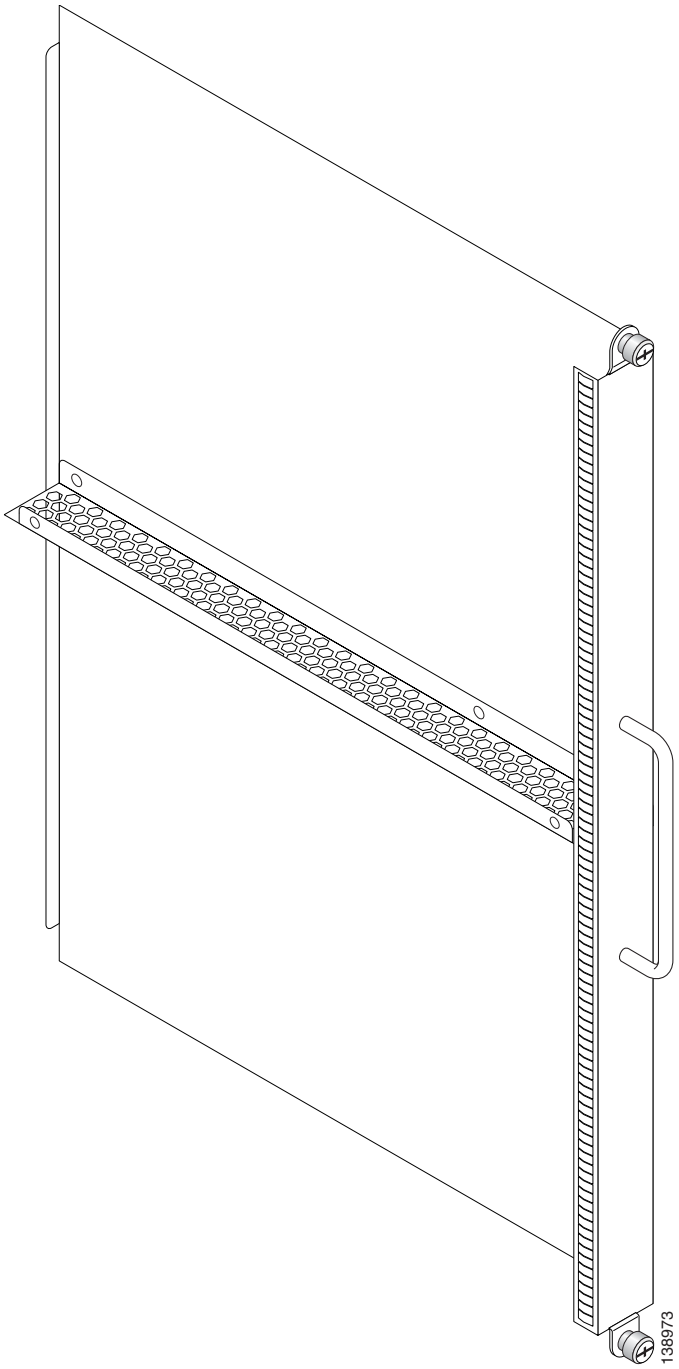


Figure 4-7 MSC Slot Impedance Carrier



For more information, see the "Removing an Impedance Carrier" section on page 4-10 and "Installing an Impedance Carrier" section on page 4-10.

Removing an Impedance Carrier

This section describes how to remove an impedance carrier from the Cisco CRS-1 4-slot line card chassis. All impedance carrier types are removed in the same manner.

Prerequisites

There are no prerequisites for this task.

Required Tools and Equipment

You need the following tools to perform this task:

- ESD-preventive wrist strap
- Large Phillips screwdriver

Steps

To remove an impedance carrier, follow these steps:

Step 1 Attach the ESD-preventive wrist strap to your wrist and connect its leash to one of the ESD connection sockets on the front (PLIM) side of the chassis or a bare metal surface on the chassis.

Step 2 Identify the impedance carrier to be removed from the card cage. Use the screwdriver to turn the two captive screws on the front panel of the card counterclockwise to loosen it from the slot.

Step 3 Grasp the impedance carrier handle with one hand and gently pull it halfway from the slot.

Step 4 Place one hand under the impedance carrier to guide it.

Step 5 Holding the impedance carrier underneath and by the handle, pull it from the slot and set it carefully aside.

What to Do Next

After performing this task, store the impedance carrier for future use. You may now install a card in the uncovered slot. See the "Installing an MSC" section on page 4-33, the "Installing a PLIM" section on page 4-41, or the "Installing an RP Card" section on page 4-26 for further details.

Installing an Impedance Carrier

This section describes how to install an impedance carrier into the Cisco CRS-1 4-slot line card chassis. The chassis is shipped with impedance carriers installed in the MSC, PLIM, RP, and SFC slots. All impedance carrier types are installed in the same manner.

Prerequisites

Before performing this task, open the doors if they are installed and ensure that the slot in which you are about to install the impedance carrier is empty. Depending on the slot in which you are installing an impedance carrier, see the "Removing an MSC" section on page 4-37, the "Removing a PLIM" section on page 4-46, or the "Removing an RP Card" section on page 4-29.

Required Tools and Equipment

You need the following tools and part to perform this task:

- ESD-preventive wrist strap
- Large Phillips screwdriver
- Impedance carrier
  - SFC impedance carrier (Cisco product number: CRS-4-FC-BLANK)
  - MSC impedance carrier (Cisco product number: CRS-MSC-IMPEDANCE=)
  - PLIM impedance carrier (Cisco product number: CRS-INT-IMPEDANCE=)
  - RP impedance carrier (Cisco product number: CRS-RP-4-BLANK=)

Steps

To install an impedance carrier, follow these steps:

Step 1 Attach the ESD-preventive wrist strap to your wrist and connect its leash to one of the ESD connection sockets on the front (PLIM) side of the chassis or a bare metal surface on the chassis.

Step 2 Use both hands while inserting an impedance carrier. Use one hand on the faceplate and the other hand along the base of the impedance carrier to guide it into a slot.

Step 3 Slide the impedance carrier into the chassis until the captive screw plates are flush with the chassis.

Step 4 Partially tighten the two captive screws on the front panel of the impedance carrier (either by hand or with the screwdriver) to make sure that they are both engaged.

Step 5 Use the screwdriver to fully tighten the captive screws to seat the impedance carrier firmly in the slot.

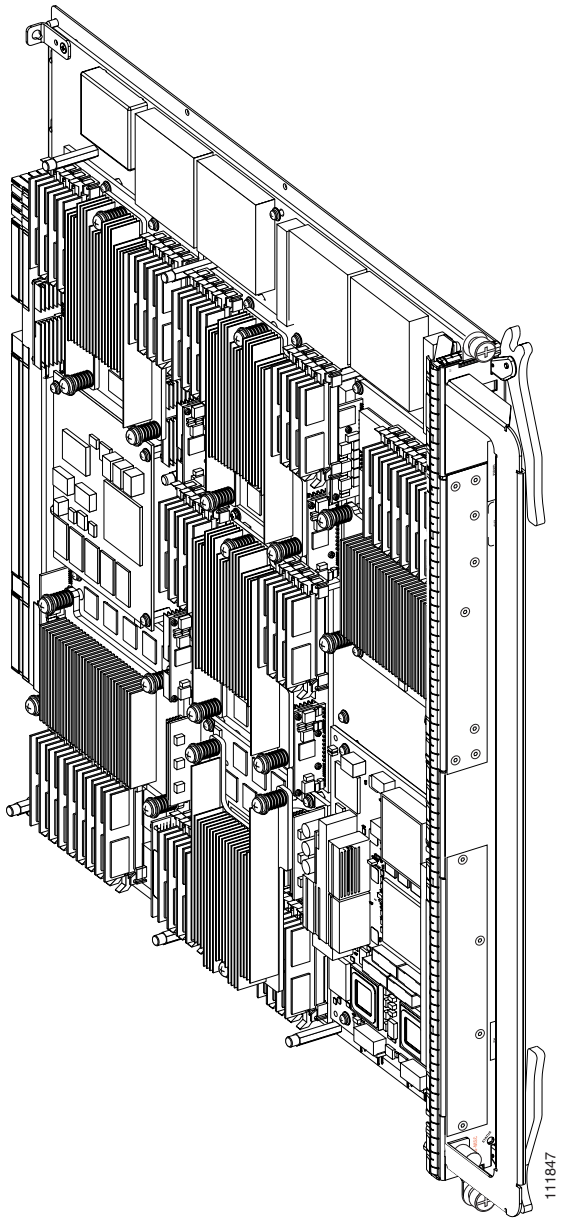
How to Remove or Install a Card Slide-Assistance Arm (Handle)

This section contains the following procedures:

- Removing a Card Slide-Assistance Arm
- Installing a Card Slide-Assistance Arm

All MSCs, PLIMs, and RPs are shipped with slide-assistance arms (sometimes called *handles*) attached. SPAs, the SIP-800, and SFCs are not shipped with slide-assistance arms. Figure 4-8 shows a slide-assistance arm attached to an MSC.

Figure 4-8 Modular Services Card (CRS-MSC) with Slide-Assistance Arm Attached



Removing a Card Slide-Assistance Arm

This section describes how to remove a slide-assistance arm (handle) from an MSC, PLIM, or RP card. For details about installing or removing the cards themselves, see the "How to Install or Remove a Modular Services Card" section on page 4-33, the "How to Install or Remove a PCMCIA Card" section on page 4-50, and the "How to Install or Remove a Physical Layer Interface Module" section on page 4-41.

Prerequisites

No prerequisites exist for this task.

Caution *Do not lift cards by the slide-assistance arm*. Rotate cards onto their vertical axes, then lift them from the bottom, using the slide-assistance arm only as an aid for balance.

Required Tools and Equipment

You need the following tools and part to perform this task:

- ESD-preventive wrist strap
- Small Phillips screwdriver.

Steps

To remove a slide-assistance arm, follow these steps:

Step 1 Attach the ESD-preventive wrist strap to your wrist and connect its leash to one of the ESD connection sockets on the front (PLIM) side of the chassis or a bare metal surface on the chassis.

Step 2 Using the small Phillips screwdriver, turn the two captive screws (one top, one bottom) on the slide-assistance arm counter-clockwise to detach the arm from the card face.

Step 3 Set the slide-assistance arm carefully aside. We recommend storing it in the original Cisco packaging.

What to Do Next

After performing this task, you may install or remove the card as necessary.

Installing a Card Slide-Assistance Arm

This section describes how to install a slide-assistance arm on an MSC, PLIM, or RP card. For details about installing or removing the cards themselves, see the "How to Install or Remove a Modular Services Card" section on page 4-33, the "How to Install or Remove a PCMCIA Card" section on page 4-50, and the "How to Install or Remove a Physical Layer Interface Module" section on page 4-41.

Prerequisites

Before performing this task, be sure to remove the slide-assistance arm and its attachment screws from the packaging, and have the appropriate card available for attachment.

Caution *Do not lift cards by the slide-assistance arm*. Rotate cards onto their vertical axes, then lift them from the bottom, using the slide-assistance arm only as an aid for balance.

Required Tools and Equipment

You need the following tools and part to perform this task:

- ESD-preventive wrist strap
- Medium Phillips screwdriver
- Card—MSC (CRS-MSC or CRS-MSC-B. Refer to the product data sheets for ordering details.); PLIM; RP card (Cisco product number: CRS-8-RP=)

Steps

To install a slide-assistance arm, follow these steps:

Step 1 Attach the ESD-preventive wrist strap to your wrist and connect its leash to one of the ESD connection sockets on the front (PLIM) side of the chassis or a bare metal surface on the chassis.

Step 2 Place the slide-assistance arm against the card face so that the screw holes on the card align with the captive screws on the slide-assistance arm.

Step 3 Using the screwdriver, turn the two screws (one top, one bottom) clockwise to attach the slide-assistance arm to the card face.

Note We recommend keeping the original Cisco packaging for future storage of the slide-assistance arm, should it become necessary.

What to Do Next

After performing this task, you may install or remove the card as necessary.

How to Install or Remove a Pillow Block

This section contains the following procedures:

- Installing a Pillow Block
- Removing a Pillow Block

Installing a Pillow Block

This section describes how to install a replacement pillow block on the chassis after removing a damaged pillow block. A pillow block is a bracket with a pin that is attached to the chassis above and below each card slot. When you install or remove a card from the chassis, the card ejector levers hook into the pillow blocks above and below the card slot to secure the cards to the slot and allow you to install and remove the cards.

Prerequisites

Before performing this task, you must first open the front cosmetic doors (if installed). Have the pillow block replacement kit (Cisco product number: CRS-4-PILLBLK=) at hand.

Required Tools and Equipment

You need the following tools and parts to perform this task:

- ESD-preventive wrist strap
- Phillips screwdriver
- Pillow block replacement kit (Cisco product number: CRS-4-PILLBLK=)

The following items are included in the CRS-4-PILLBLK= pillow block replacement kit:

- 2 replacement pillow blocks
- 6 Phillips-head screws

Note A Phillips screwdriver is not included in the CRS-4-PILLBLK= pillow block replacement kit.

Steps

To install a pillow block, follow these steps:

Step 1 Attach the ESD-preventive wrist strap to your wrist and connect its leash to one of the ESD connection sockets on the front (PLIM) side of the chassis or a bare metal surface on the chassis.

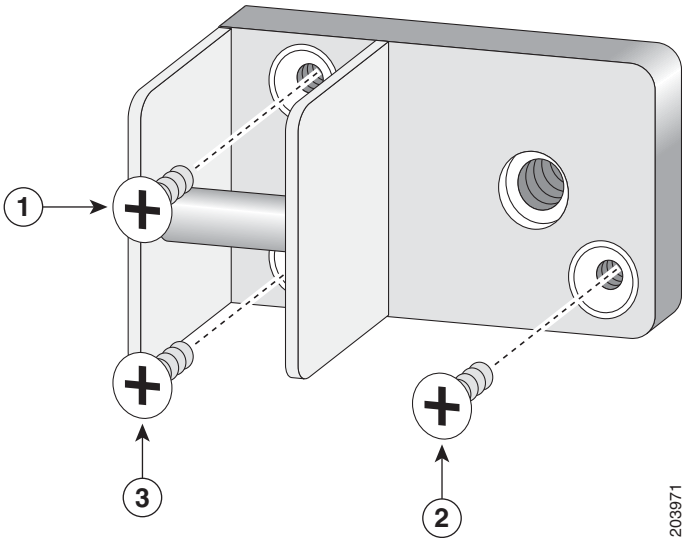
Step 2 Locate the slot where the pillow block was removed.

Step 3 Have the replacement Phillips-head screws near at hand.

Step 4 Position the pillow block and align the screw holes.

Step 5 Use a Phillips screwdriver to install the top left screw (located above the pillow block pin). (See item number 1 in Figure 4-9.)

Figure 4-9 Installing a Pillow Block



Step 6 Install the lower right screw (see item number 2 in Figure 4-9).

Step 7 Install the lower left screw (located below the pillow block pin). (See item number 3 in Figure 4-9.)

Step 8 Repeat this procedure for the card slot's other pillow block if necessary.

What to Do Next

After performing this task, replace any cosmetic covers.

Removing a Pillow Block

This section describes how to remove a damaged pillow block from the chassis. A pillow block is a bracket with a pin that is attached to the chassis above and below each card slot. When you install or remove a card from the chassis, the card ejector levers hook into the pillow blocks above and below the card slot to secure the cards to the slot and allow you to install and remove the cards.

Prerequisites

Before performing this task, you must first open the front cosmetic doors (if installed). Have the pillow block replacement kit (Cisco product number: CRS-4-PILLBLK=) at hand.

Required Tools and Equipment

You need the following tools and parts to perform this task:

- ESD-preventive wrist strap
- Phillips screwdriver
- Pillow block replacement kit (Cisco product number: CRS-4-PILLBLK=)

The following items are included in the CRS-4-PILLBLK= pillow block replacement kit:

- 2 replacement pillow blocks
- 6 Phillips-head screws

Note A Phillips screwdriver is not included in the CRS-4-PILLBLK= pillow block replacement kit.

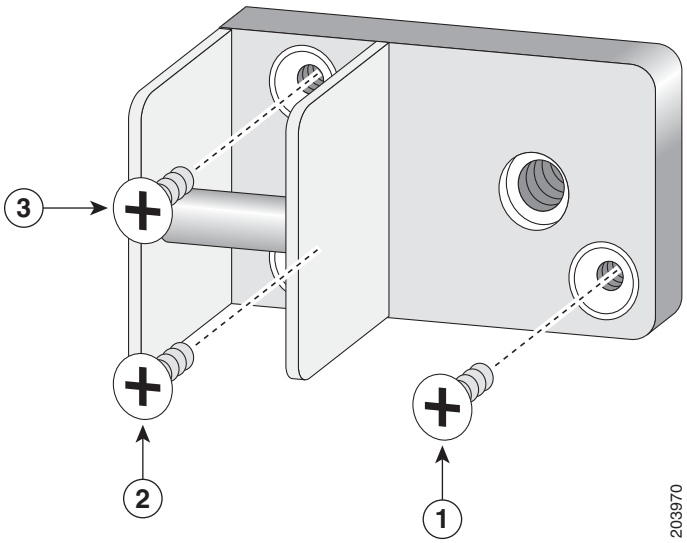
Steps

To remove a pillow block, follow these steps:

Step 1 Attach the ESD-preventive wrist strap to your wrist and connect its leash to one of the ESD connection sockets on the front (PLIM) side of the chassis or a bare metal surface on the chassis.

Step 2 Locate the pillow block to be replaced. Use a Phillips screwdriver to remove the lower right screw. (See item number 1 in Figure 4-10.)

Figure 4-10 Removing a Pillow Block



Step 3 Remove the lower left screw (located below the pillow block pin). (See item number 2 in Figure 4-10.)

Step 4 Remove the top left screw (located above the pillow block pin). (See item number 3 in Figure 4-10.)

Step 5 Remove the pillow block and set it aside.

Step 6 Repeat this procedure for the card slot's other pillow block if necessary.

What's Next

After performing this task, you may install a new pillow block (see the "Installing a Pillow Block" section on page 4-14).

How to Install or Remove a Switch Fabric Card

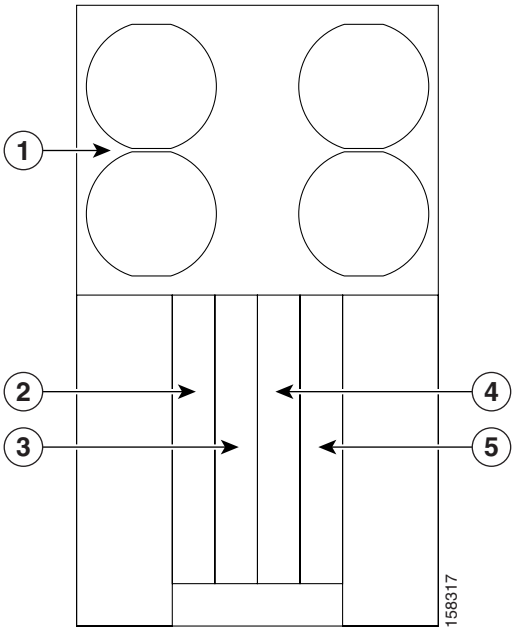
This section contains the following procedures:

- Switch Fabric Card Location and Slot Numbers
- Installing a Switch Fabric Card
- Removing a Switch Fabric Card
- Verifying the Installation of a Switch Fabric Card

Switch Fabric Card Location and Slot Numbers

The switch fabric cards are installed in the rear of the chassis in the card cage below the fan tray. Figure 4-11 shows the location and slot numbers assigned to the switch fabric cards.

Figure 4-11 Cisco CRS-1 4-Slot Line Card Chassis Slot Numbers—Rear (SFC) Side

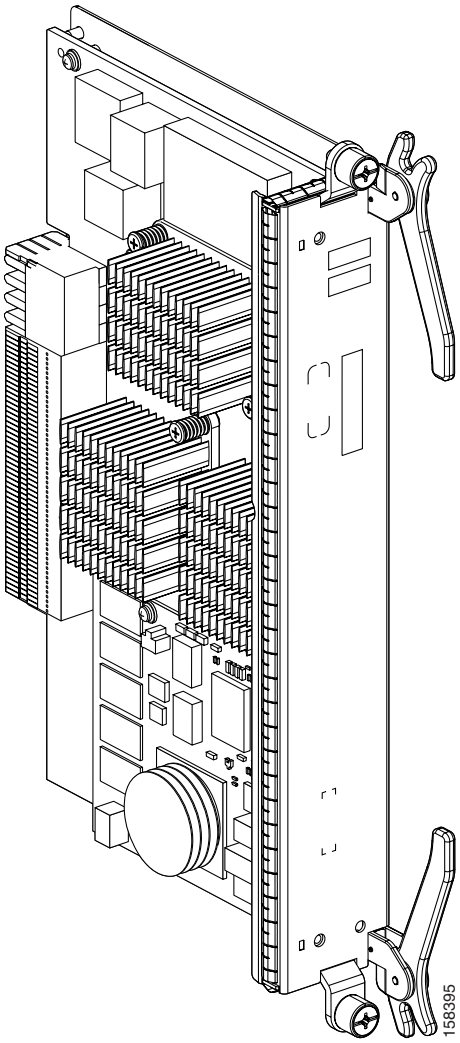


1	Fan tray (FT0)	**4**	Switch fabric card slot (SM1)
2	Switch fabric card slot (SM3)	**5**	Switch fabric card slot (SM0)
3	Switch fabric card slot (SM2)		

Installing a Switch Fabric Card

This section describes how to install a switch fabric card in the Cisco CRS-1 4-slot line card chassis (see Figure 4-12). For more detailed information on the switch fabric card, see *Cisco CRS-1 Series Carrier Routing System 4-Slot Line Card Chassis System Description*.

Figure 4-12 Switch Fabric Card



Prerequisites

Before performing this task, remove the switch fabric card (if there is already one installed) or the switch fabric impedance carrier from the slot in which you plan on installing the switch fabric card. See the "Removing an Impedance Carrier" section on page 4-10 and the "Removing a Switch Fabric Card" section on page 4-22.

Required Tools and Equipment

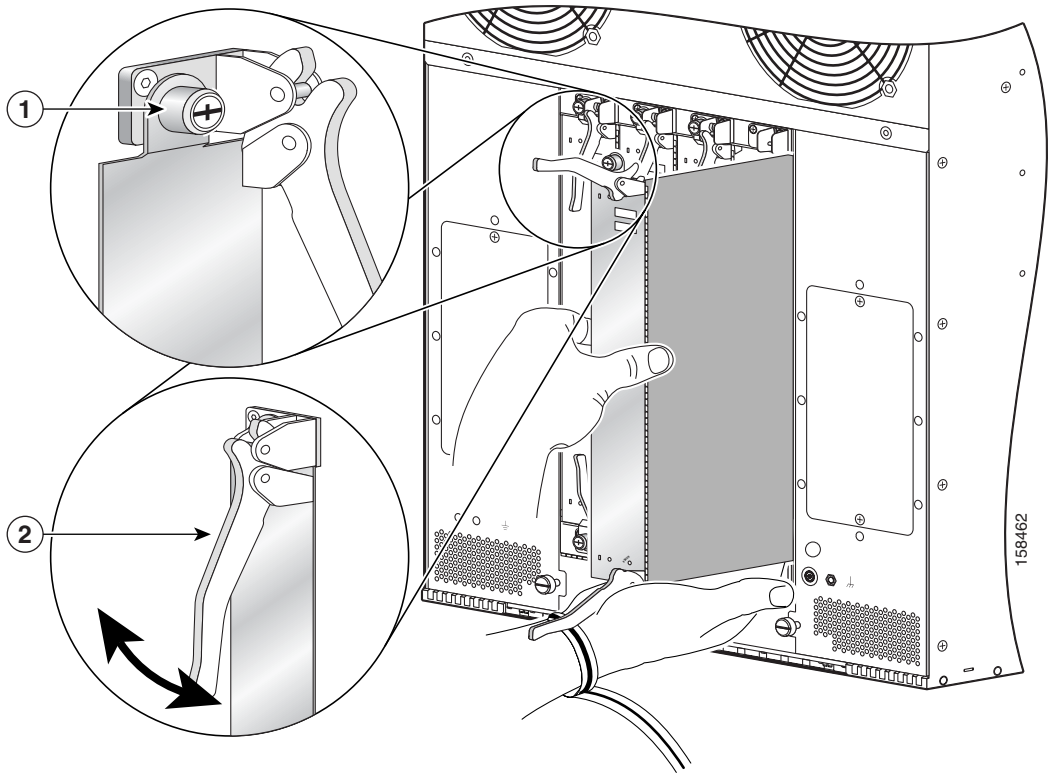
You need the following tools and part to perform this task:

- ESD-preventive wrist strap
- Large Phillips screwdriver
- Switch fabric card (Cisco product number: CRS-4-FC=)

Steps

To install a switch fabric card, see Figure 4-13 and follow these steps:

Figure 4-13 Installing a Switch Fabric Card



1	Captive screw	**2**	Ejector lever and its direction of installation or removal

Step 1 Go to the rear of the chassis. Attach the ESD-preventive wrist strap to your wrist and connect its leash to one of the ESD connection sockets on the rear (SFC) side of the chassis or a bare metal surface on the chassis.

Step 2 Remove the switch fabric card from its antistatic packaging.

Step 3 Use a medium Phillips screwdriver to remove the switch fabric card from its protective carrier.

Step 4 Visually inspect the connector pins on the card before you insert it into the chassis.

Note Do not attempt to install a card with bent pins, because this may damage the chassis midplane connectors.

Step 5 Identify the card slot in the card cage where the switch fabric card should be installed.

a. If there is an impedance carrier in the slot, remove it (see the "Removing an Impedance Carrier" section on page 4-10.)

b. If there is a switch fabric card already installed in the slot, remove the card (see the "Removing a Switch Fabric Card" section on page 4-22).

Step 6 Grasp the face plate of the card with one hand and place your other hand under the card to support and guide it into the correct slot.

Step 7 Orient the route processor card so that the status display is on top, then position the card for insertion into the card cage slot. Avoid touching the card circuitry or any connectors.

Note There are alignment grooves on each slot in the card cage. When you install a card, make sure that you align both the top and bottom edges of the card carrier in the slot grooves.

Step 8 Grasp both card ejector levers simultaneously, then push them both outward until they are fully extended in the open position.

Step 9 Carefully slide the switch fabric card into the slot until the ejector levers meet the edges of the card cage, then *stop* when the ejector lever hooks catch the lip of the card cage. If they do not catch, try reinserting the switch fabric card until the ejector lever hooks are fully latched.

Step 10 To fully seat the card in the midplane connector, grasp both card ejector levers simultaneously, then push them both inward until they are flush against the front edge of the card carrier.

Caution Verify that the openings on the card ejector cams pass over the tabs; otherwise, one or both ejector levers may bind when you attempt to close the levers, thereby damaging or breaking one or both of them.

Note Switch fabric cards have guide pins that make initial contact with the midplane connector as you slide a card into its slot. After the guide pins make contact, continue pushing the card carrier until the card ejector levers begin pivoting forward.

Step 11 To seat the card firmly in the slot, use the screwdriver to tighten the captive screws.

What to Do Next

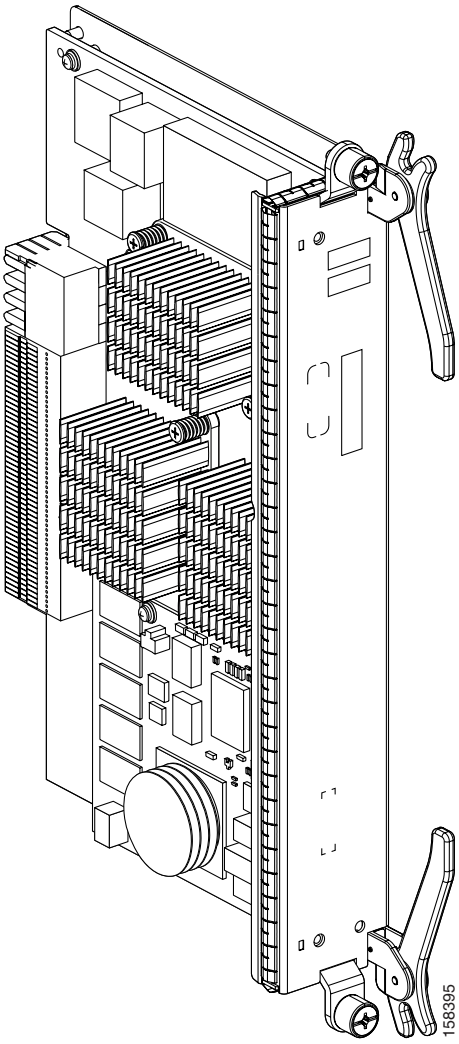
After performing this task:

- Place the impedance carrier in an antistatic bag for storage and future use.
- If you are performing the initial installation of the system, install the RPs (see the "Installing an RP Card" section on page 4-26).

Removing a Switch Fabric Card

This section describes how to remove a switch fabric card from the Cisco CRS-1 4-slot line card chassis. For more detailed information on the switch fabric card, see *Cisco CRS-1 Series Carrier Routing System 4-Slot Line Card Chassis System Description*.

Figure 4-14 Switch Fabric Card



Prerequisites

There are no prerequisites for this task.

Required Tools and Equipment

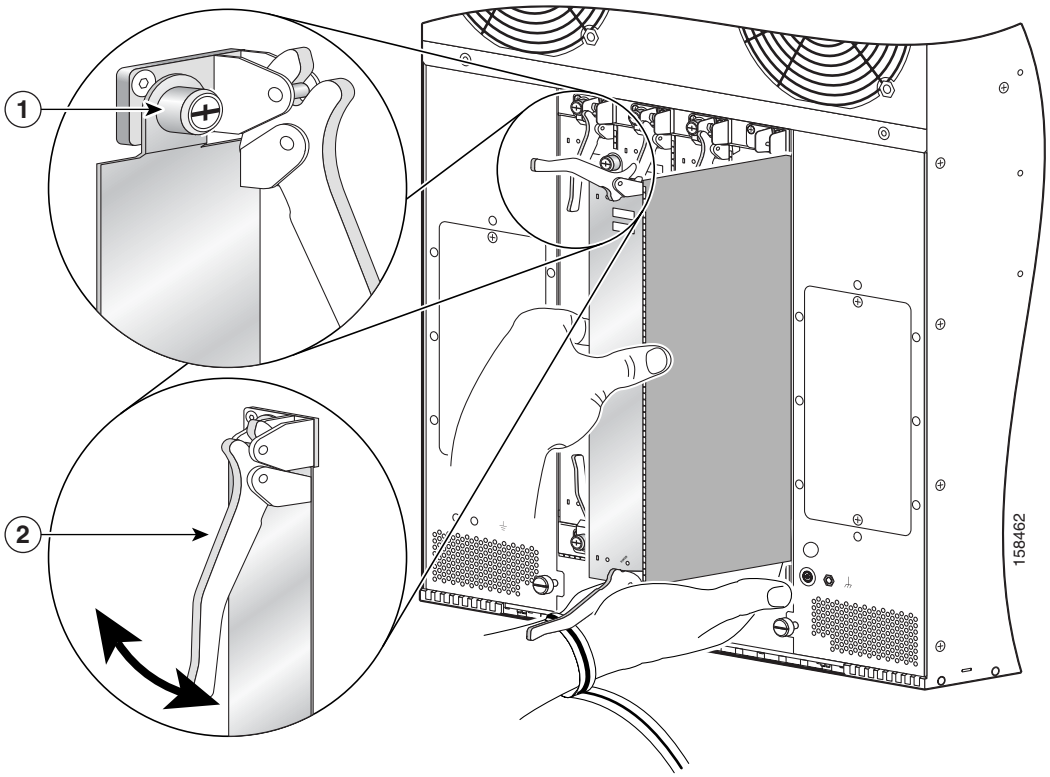
You need the following tools to perform this task:

- ESD-preventive wrist strap
- Large Phillips screwdriver

Steps

To remove a switch fabric card, see Figure 4-15 and follow these steps:

Figure 4-15 Removing a Switch Fabric Card



1	Captive screw	**2**	Ejector lever

Step 1 Attach the ESD-preventive wrist strap to your wrist and connect its leash to one of the ESD connection sockets on the rear (SFC) side of the chassis or a bare metal surface on the chassis.

Caution Removing more than one switch fabric card at a time can misalign the chassis and may damage the card or chassis when reinserting the cards. Remove and insert only one switch fabric card at a time.

Step 2 Identify the switch fabric card to be removed from the card cage. Use the screwdriver to turn the two captive screws on the front panel of the card counterclockwise to loosen it from the slot.

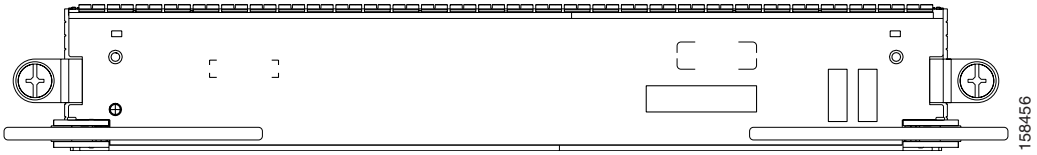
Step 3 To unseat the card from the midplane connector, grasp the two card ejector levers and simultaneously pivot both ejector levers outward from the front edge of the card slot. As you pivot the ejector levers outward, the switch fabric card is partially pulled from the slot.

Step 4 Touching only the metal card carrier, slide the card from the slot and place it directly into an antistatic sack or other ESD-preventive container. If you plan to return the defective card to the factory, repackage it in its original shipping container.

Verifying the Installation of a Switch Fabric Card

This section describes how to verify that a switch fabric card has been properly installed. (Figure 4-16 shows the switch fabric card front panel.)

Figure 4-16 Switch Fabric Card Front View



Understanding the LEDs

Alphanumeric LEDs

At one end of the faceplate, near an ejector lever, a switch fabric card has an alphanumeric LED display that shows a sequence of messages indicating the state of the card.

Note It is normal for some displayed messages to appear too briefly in the LED display to be read.

Status LEDs

Use the status LEDs, located on the switch fabric card faceplate, to verify the correct installation of the card:

- When the card is properly installed, the Status LED turns green. If this LED is off, make sure that the card is installed correctly.
- When the Status is blinking yellow, a problem exists on the board.
- When the Status is off, the board state is unknown. Verify that there is power to the board by looking at the indicators on the power module.
- If there is a failure during the board boot sequence, the two-row, four-character alphanumeric display indicates the current boot phase, to assist you in debugging the board failure.

Troubleshooting the Switch Fabric Card

If the installed or replaced switch fabric card fails to operate or to power up on installation:

- Make sure that the card is seated firmly in the Cisco CRS-1 4-slot line card chassis slot. One easy way to verify physical installation is to see whether the front faceplate of the switch fabric card is even with the fronts of the other cards installed in the card cage.
- Check whether the ejector levers are latched and that the captive screws are fastened properly. If you are uncertain, unlatch the levers, loosen the screws, and attempt to reseat the switch fabric card.

- Examine the alarm LEDs to see if there are any active alarm conditions.
- Examine the power shelves to see whether the chassis, as a whole, is receiving power.

How to Install or Remove a Route Processor Card

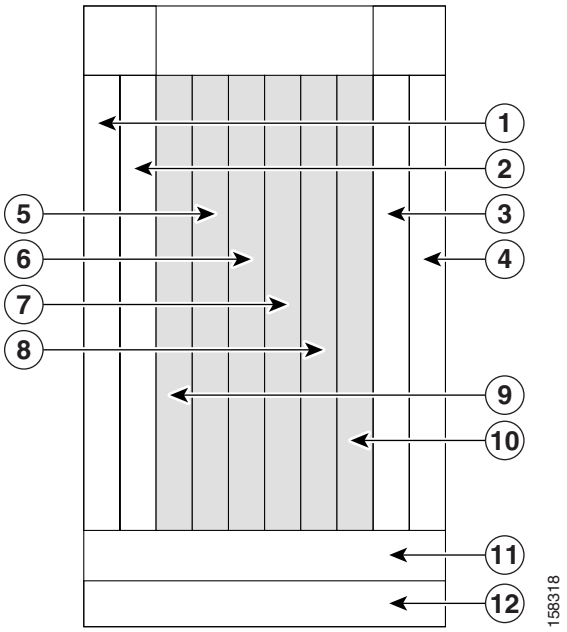
This section contains the following procedures:

- Location and Slot Numbers for the RPs, MSCs, and PLIMs
- Installing an RP Card
- Removing an RP Card
- Verifying the Installation of an RP Card
- Installing a PCMCIA Card
- Removing an RP PCMCIA Card

Location and Slot Numbers for the RPs, MSCs, and PLIMs

The route processors, MSCs, and PLIMs are installed in the front of chassis. Figure 4-17 shows the location and slot numbers for these cards:

Figure 4-17 Cisco CRS-1 4-Slot Line Card Chassis Slot Numbers—Front (PLIM) Side



1	MSC slot 0	**7**	PLIM slot 2
2	MSC slot 1	**8**	PLIM slot 3
3	MSC slot 2	**9**	RP slot (RP0)

4	MSC slot 3	**10**	RP slot (RP1)
5	PLIM slot 0	**11**	Air intake
6	PLIM slot 1	**12**	AC or DC power shelf

Installing an RP Card

This section describes how to install a route processor (RP) card in the chassis (see Figure 4-18). For more detailed information on the route processor card, see *Cisco CRS-1 Carrier Routing System 4-Slot Line Card Chassis System Description*.

Every Cisco CRS-1 4-slot line card chassis contains two RP cards in dedicated slots on the front (PLIM) side of the chassis (see Figure 4-18).

Note For enhanced immunity to external electromagnetic disturbance levels of 10 V per meter and 10 V RMS, you must use a shielded Ethernet (CAT5 or better STP) cable on the Management Ethernet connection of the route processor card.

RP Installation Guidelines

Chassis operation may be effected by the installation of a route processor card. A route processor card is normally installed under one of the following conditions:

- When you are certain that the second RP in the chassis is operational and, if not already the active RP, ready to assume control (this happens automatically).
- When the chassis is undergoing scheduled maintenance.
- When the Cisco CRS-1 4-slot line card chassis is powered down.

Monitoring the RP Card Start-Up Process

Monitoring the RP card during its start-up process must be done through a console port connection. For details, see the latest release of the *Cisco IOS XR Getting Started Guide* on www.cisco.com.

To monitor the RP card during its start-up, follow these steps:

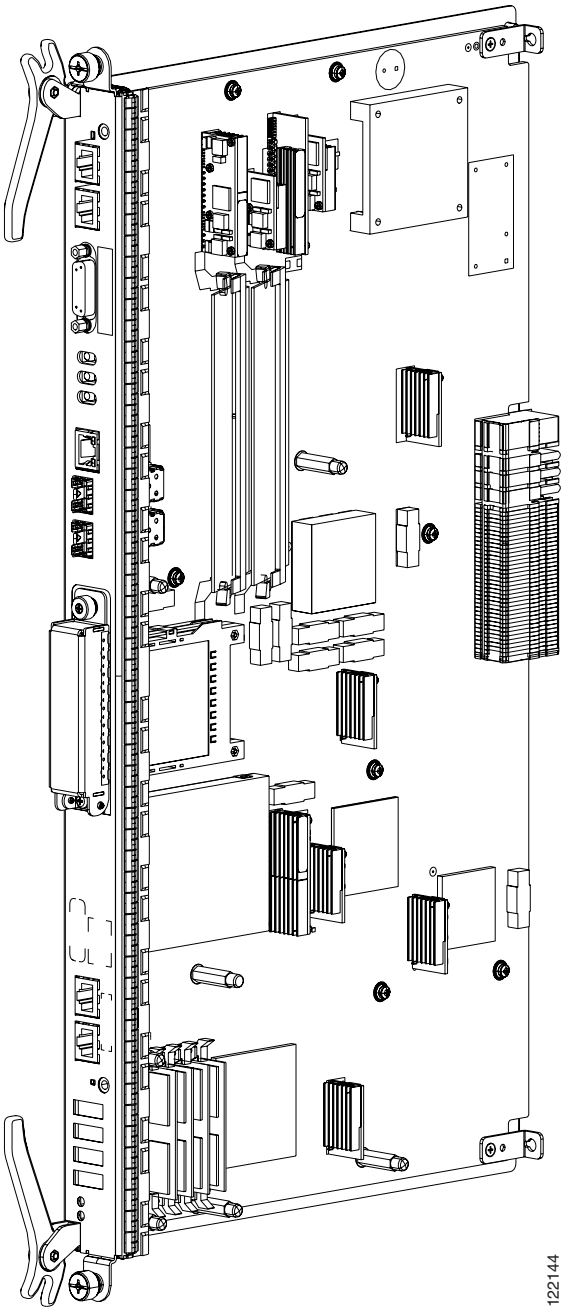
Step 1 Install the console port connection to the front of the RP.

Tip If you want to monitor the start-up process on the RP, you must physically attach the console port connection and open the console port connection prior to inserting the RP into its designated slot.

Step 2 Insert the RP into its designated slot as described in this section.

Step 3 At the console, verify the status of the RP.

Figure 4-18 Route Processor (RP) Card



Prerequisites

Required Tools and Equipment

You need the following tools and part to perform this task:

- ESD-preventive wrist strap
- Large Phillips screwdriver
- Route processor card (Cisco product number: CRS-8-RP=)

Steps

To install a route processor card, follow these steps:

Step 1 Go to the front of the chassis. Attach the ESD-preventive wrist strap to your wrist and connect its leash to one of the ESD connection sockets on the rear side of the chassis or a bare metal surface on the chassis.

Step 2 Remove the route processor card from its antistatic packaging.

Step 3 Use a medium Phillips screwdriver to remove the route processor card from its protective carrier.

Step 4 Visually inspect the connector pins on the card before you insert it into the chassis.

Note Do not attempt to install a card with bent pins, because this may damage the chassis midplane connectors.

Step 5 Identify the card slot in the card cage where the route processor card should be installed.

a. If there is an impedance carrier in the slot, remove it (see the "Removing an Impedance Carrier" section on page 4-10.)

b. If there is an RP card already installed in the slot, remove any cables connected to the front panel of an existing card in the slot, then remove the card (see the "Removing an RP Card" section on page 4-29).

Step 6 Grasp the face plate of the card with one hand and place your other hand under the card to support and guide it into the correct slot.

Step 7 Orient the route processor card so that the status display is on top, then position the card for insertion into the card cage slot. Avoid touching the card circuitry or any connectors.

Note There are alignment grooves on each slot in the card cage. When you install a card in the card cage, make sure that you align both the top and bottom edges of the card carrier in the slot grooves.

Step 8 Grasp both card ejector levers simultaneously, then push them both outward until they are fully extended in the open position.

Step 9 Carefully slide the route processor card into the slot until the ejector levers meet the edges of the card cage, then *stop* when the ejector lever hooks catch the lip of the card cage. If they do not catch, try reinserting the route processor card until the ejector lever hooks are fully latched.

Step 10 To fully seat the card in the midplane connector, grasp both card ejector levers simultaneously, then push them both inward until they are flush against the front edge of the card carrier. After the guide pins make contact, continue pushing the card carrier until the card ejector levers begin pivoting forward.

Caution Verify that the openings on the card ejector cams pass over the tabs; otherwise, one or both ejector levers may bind when you attempt to close the levers, thereby damaging or breaking one or both.

Step 11 To seat the card firmly in the slot, use the screwdriver to tighten the captive screws.

Note To comply with the Telcordia GR-1089 NEBS standard for electromagnetic compatibility and safety, connect the Ethernet interfaces only to intrabuilding or nonexposed wiring or cabling. The intrabuilding cable must be shielded and the shielding must be grounded at both ends.

What to Do Next

After performing this task:

- Place the impedance carrier in an antistatic bag for storage and future use.
- Verify that the card has been installed properly (see the "Verifying the Installation of an RP Card" section on page 4-31).
- Connect the console port and LAN port. For more information, see the latest release of the *Cisco IOS XR Getting Started Guide* on www.cisco.com.
- If you are performing the initial installation of the system, install the MSCs (see the "Installing an MSC" section on page 4-33).

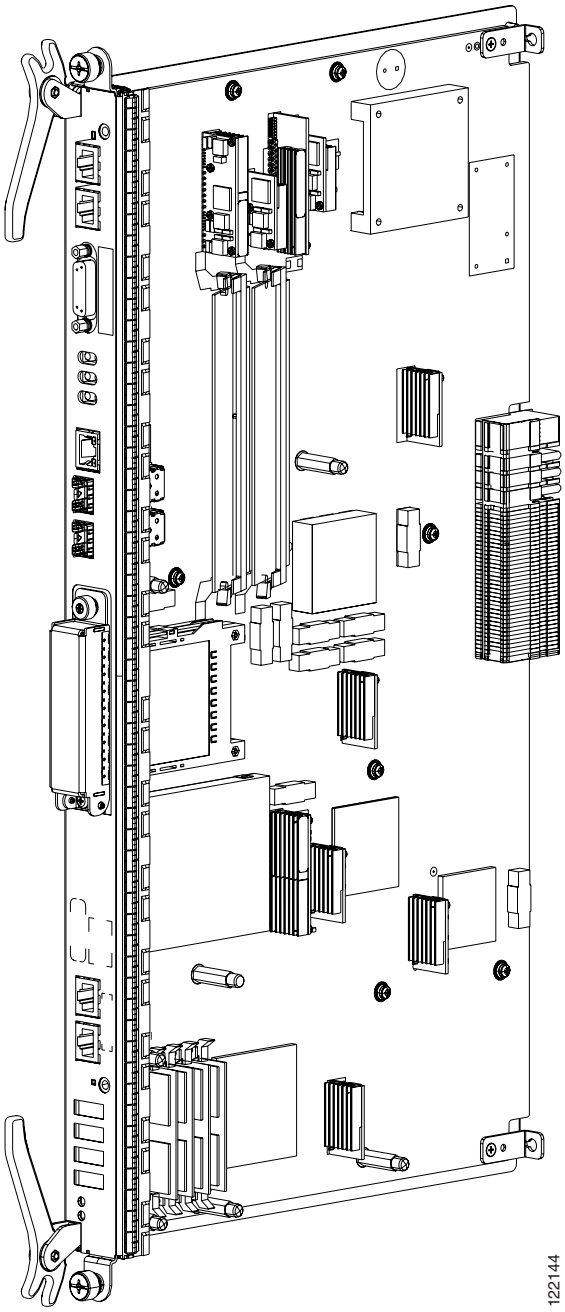
Removing an RP Card

This section describes how to remove a route processor (RP) card from the chassis. For more detailed information on the route processor card, see *Cisco CRS-1 Series Carrier Routing System 4-Slot Line Card Chassis System Description*.

Every Cisco CRS-1 4-slot line card chassis contains two route processor cards in dedicated slots on the front (PLIM) side of the chassis (see Figure 4-19).

Note For enhanced immunity to external electromagnetic disturbance levels of 10 V per meter and 10 V RMS, you must use a shielded Ethernet (CAT5 or better STP) cable on the Management Ethernet connection of the RP card.

Figure 4-19 Route Processor (RP) Card



Prerequisites

Because chassis operation may be impacted by the removal of an RP card, perform these tasks only if one of the following conditions exists:

- When you are certain that the second RP in the chassis is operational and, if not already the active RP, ready to assume control (this happens automatically).
- When the chassis is undergoing scheduled maintenance.
- When the Cisco CRS-1 4-slot line card chassis is powered down.

Failure to follow these guidelines can result in interruptions in data communications and network connectivity.

Required Tools and Equipment

You need the following tools to perform this task:

- ESD-preventive wrist strap
- Large Phillips screwdriver

Steps

To remove an RP card, follow these steps:

Step 1 Attach the ESD-preventive wrist strap to your wrist and connect its leash to one of the ESD connection sockets on the front (PLIM) side of the chassis or a bare metal surface on the chassis.

Step 2 Identify the card to be removed from the card cage. Remove any cables connected to the front panel of the card.

Step 3 Use the screwdriver to turn the two captive screws on the front panel of the card counterclockwise to loosen the card from the slot.

Step 4 Grasp the two card ejector levers and simultaneously pivot both ejector levers 90 degrees away from the front edge of the card carrier to unseat the card from the backplane connector.

Step 5 Touching only the metal card carrier, slide the card from the slot and place it directly into an antistatic sack or other ESD-preventive container. If you plan to return the defective card to the factory, repackage it in the shipping container you received with the replacement card.

Verifying the Installation of an RP Card

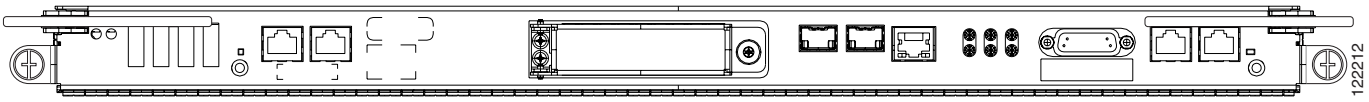
This section describes how to verify and troubleshoot the installation of a route processor (RP) card in the Cisco CRS-1 4-slot line card chassis. For more detailed information on the RP card, see *Cisco CRS-1 Series Carrier Routing System 4-Slot Line Card Chassis System Description*.

This section describes how to verify that the card has been properly installed. Status indicators on the RP front panel include:

- Alphanumeric LED display
- Status OK LED
- Active/Standby LED

Figure 4-20 shows the RP card front panel.

Figure 4-20 RP Card Front Panel



Understanding the LEDs

Alphanumeric LEDs

At one end of the faceplate, near an ejector lever, an RP card has an alphanumeric LED display that shows a sequence of messages indicating the state of the card.

Note It is normal for some displayed messages to appear too briefly in the alphanumeric LED display to be read.

Status LEDs

Use the status LEDs, located on the card faceplate, to verify the correct installation of the card:

- When the card is properly installed, the Status LED turns green. If this LED is off, verify that the card is installed correctly.
- When the Status LED is blinking yellow, a problem exists on the board.
- When the Status LED is off, the board state is unknown. Verify that there is power to the board by looking at the indicators on the power module.
- When the Primary LED is on, the board is executing control processing functions and is not in a secondary or standby role.
- If there is a failure during the board boot sequence, the four-row, four-character alphanumeric display indicates the current boot phase to assist you in debugging the board failure.

Troubleshooting the RP Card

If the installed or replaced card fails to operate or to power up on installation:

- Make sure that the card is seated firmly in the Cisco CRS-1 4-slot line card chassis slot. One easy way to verify physical installation is to see whether the front faceplate of the card is even with the fronts of the other cards installed in the card cage.
- Check whether the ejector levers are latched and that the captive screws are fastened properly. If you are uncertain, unlatch the levers, loosen the screws, and attempt to reseat the card.
- Examine the alarm LEDs on the faceplate to see if there are any active alarm conditions.
- Examine the power shelves to see whether the chassis, as a whole, is receiving power.

How to Install or Remove a Modular Services Card

This section contains the following procedures:

- Installing an MSC
- Removing an MSC
- Verifying the Installation of an MSC

Installing an MSC

This section describes how to install a modular services card (MSC) in the Cisco CRS-1 4-slot line card chassis. For more detailed information on the MSC, see *Cisco CRS-1 Carrier Routing System 4-Slot Line Card Chassis System Description*.

The MSC is a Layer 3 forwarding engine in the Cisco CRS-1 routing system (see Figure 4-21).

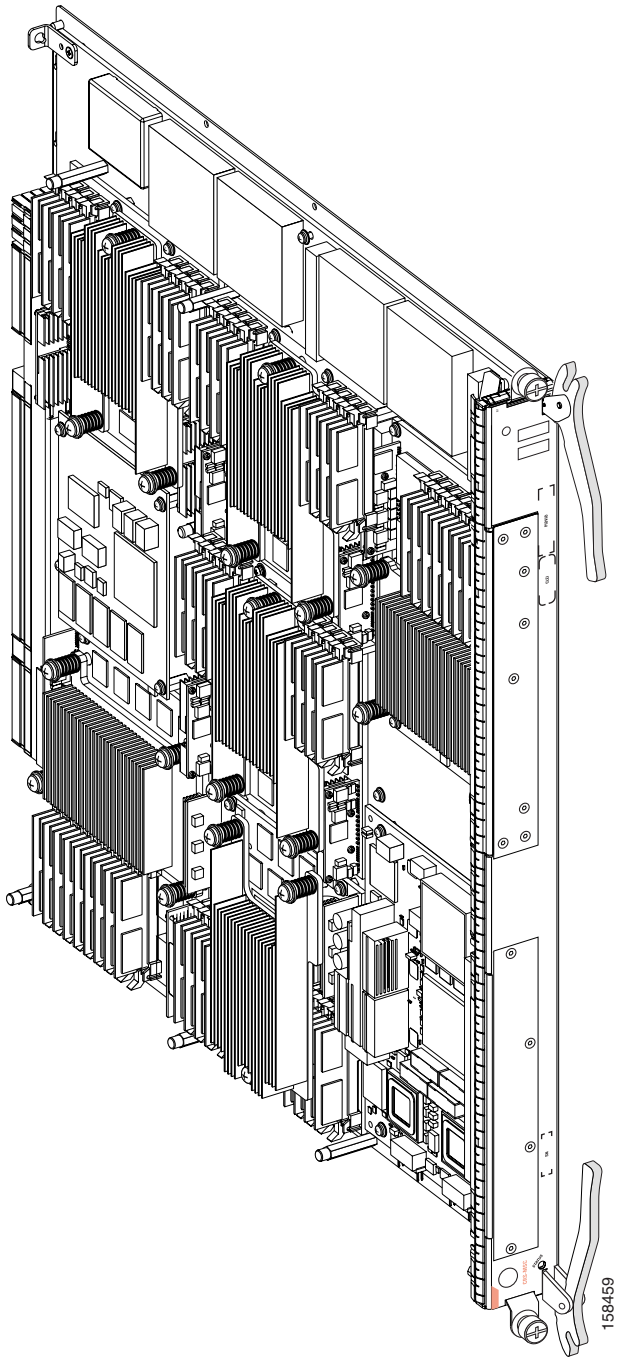
There are two versions of the MSC: the original version (CRS-MSC) and version B (CRS-MSC-B). Both versions provide the same functionality.

An MSC can be paired with different types of physical layer interface modules (PLIMs) to provide a variety of interfaces.

An MSC fits into any available MSC slot in the front of the chassis and connects directly to the midplane. There are four MSC slots, with two on the left side (MSC slot 0 and MSC slot 1) and two on the right side (MSC slot 2and MSC slot 3) (see Figure 4-17 on page 4-25).

Note If your Cisco CRS-1 4-slot line card chassis uses a Cisco CRS-1 SIP-800, refer to the "Installing and Removing a SIP" chapter in the *Cisco CRS-1 SIP and SPA Hardware Installation Guide* on www.cisco.com.

Figure 4-21 Modular Services Card (CRS-MSC)



Prerequisites

Caution Do not carry an MSC by the slide-assistance arm attached to the faceplate (if attached).

Required Tools and Equipment

You need the following tools and part to perform this task:

- ESD-preventive strap
- Small Phillips screwdriver
- Medium flat-blade or Phillips screwdriver
- Modular services card (CRS-MSC or CRS-MSC-B. Refer to the product data sheet for ordering details.)

Steps

To install a modular services card, follow these steps:

Step 1 Go to the front of the chassis. Attach the ESD-preventive wrist strap to your wrist and connect its leash to one of the ESD connection sockets on the front side of the chassis or a bare metal surface on the chassis.

Step 2 Remove the MSC from its antistatic packaging.

Step 3 Use a medium Phillips screwdriver to remove the MSC from its protective carrier.

Step 4 Remove the slide-assistance arm (handle) currently attached to the MSC:

a. Using a small Phillips screwdriver, turn the two captive screws (one top, one bottom) on the slide-assistance arm counter-clockwise to detach the arm from the card face.

b. Set the slide-assistance arm carefully aside. We recommend storing it in the original Cisco packaging.

Step 5 Visually inspect the connector pins on the card before you insert it into the chassis.

Note Do not attempt to install a card with bent pins, because this may damage the chassis midplane connectors.

Step 6 Identify the card slot in the card cage where the MSC should be installed.

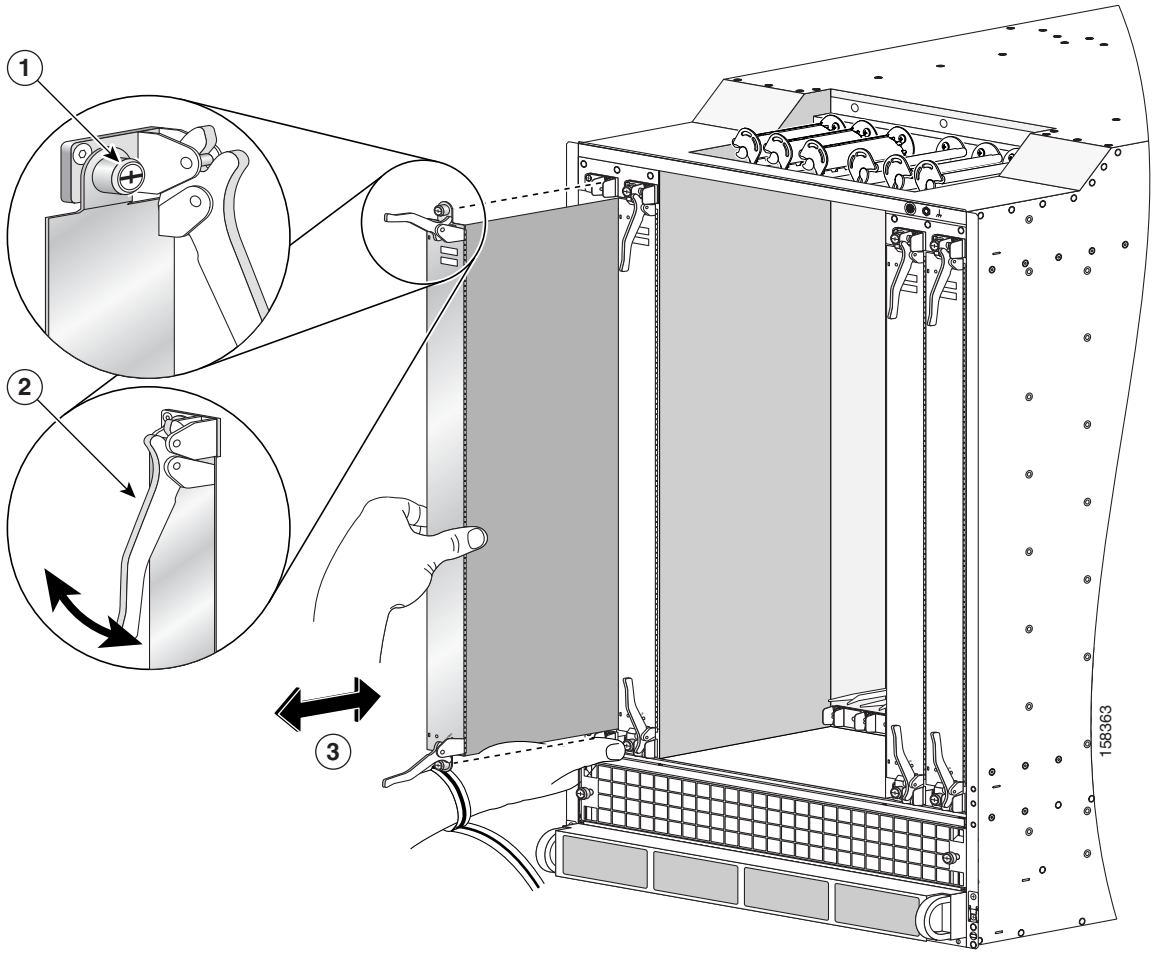
a. If there is an impedance carrier in the slot, remove it (see the "Removing an Impedance Carrier" section on page 4-10.)

Note Remove only one impedance carrier and install one MSC at a time. Be sure to verify that each MSC is fully installed and secured before installing another card.

b. If there is an MSC already installed in the slot, remove the card (see the "Removing an MSC" section on page 4-37).

Step 7 Grasp the face plate of the card with one hand and place your other hand under the card to support and guide it into the correct slot (see Figure 4-22).

Figure 4-22 Installing a Modular Services Card



1	Captive screw	**3**	Direction of installation or removal
2	Ejector lever		

Step 8 Orient the MSC so that the status display is on top, then position the card for insertion into the card cage slot. Avoid touching the card circuitry or any connectors.

Note There are alignment grooves on each slot in the card cage. When you install a card, make sure that you align both the top and bottom edges of the card carrier in the slot grooves.

Step 9 Grasp both card ejector levers simultaneously, then push them both outward until they are fully extended in the open position.

Step 10 Carefully slide the MSC into the slot until the ejector levers meet the edges of the card cage, then *stop* when the ejector lever hooks catch the lip of the card cage. If they do not catch, try reinserting the card until the ejector lever hooks are fully latched.

Note Modular services cards have guide pins that make initial contact with the midplane connector as you slide a card into its slot.

Step 11 To fully seat the card in the midplane connector, grasp both card ejector levers simultaneously, then push them both inward until they are flush against the front edge of the card carrier. After the guide pins make contact, continue pushing the card carrier until the card ejector levers begin pivoting forward.

Caution Verify that the openings on the card ejector cams pass over the tabs; otherwise, one or both ejector levers may bind when you attempt to close the levers, thereby damaging or breaking one or both of them.

Step 12 To ensure proper EMI shielding and prevent the MSC from becoming partially dislodged from the midplane, use a screwdriver to fully tighten the captive screws next to each MSC ejector lever.

Caution To ensure adequate space for additional MSCs, always tighten the captive installation screws on each newly installed MSC *before* you insert another MSC. These captive screws also prevent accidental removal and provide proper grounding and EMI shielding for the system.

What to Do Next

After performing this task:

- Place the impedance carrier in an antistatic bag for storage and future use.
- Verify that the card has been installed properly (see the "Verifying the Installation of an MSC" section on page 4-40).
- If you are performing the initial installation of the system, install the PLIMs (see the "How to Install or Remove a Physical Layer Interface Module" section on page 4-41).

Removing an MSC

This section describes how to remove an MSC from the Cisco CRS-1 4-slot line card chassis. For more detailed information on the MSC, see *Cisco CRS-1 Carrier Routing System 4-Slot Line Card Chassis System Description*.

The MSC is a Layer 3 forwarding engine in the Cisco CRS-1 routing system. An MSC can be paired with different types of physical layer interface modules (PLIMs) to provide a variety of interfaces.

An MSC fits into any available MSC slot and connects directly to the midplane.

Prerequisites

There are no prerequisites for this task.

Required Tools and Equipment

You need the following tools and part to perform this task:

- ESD-preventive strap
- Medium flat-blade or Phillips screwdriver
- Impedance carrier (Cisco product number: CRS-MSC-IMPEDANCE=)

Steps

To remove an MSC, follow these steps:

Step 1 Attach the ESD-preventive wrist strap to your wrist and connect its leash to one of the ESD connection sockets on the front (PLIM) side of the chassis or a bare metal surface on the chassis.

Step 2 Use a screwdriver to loosen the captive screw next to each MSC ejector lever.

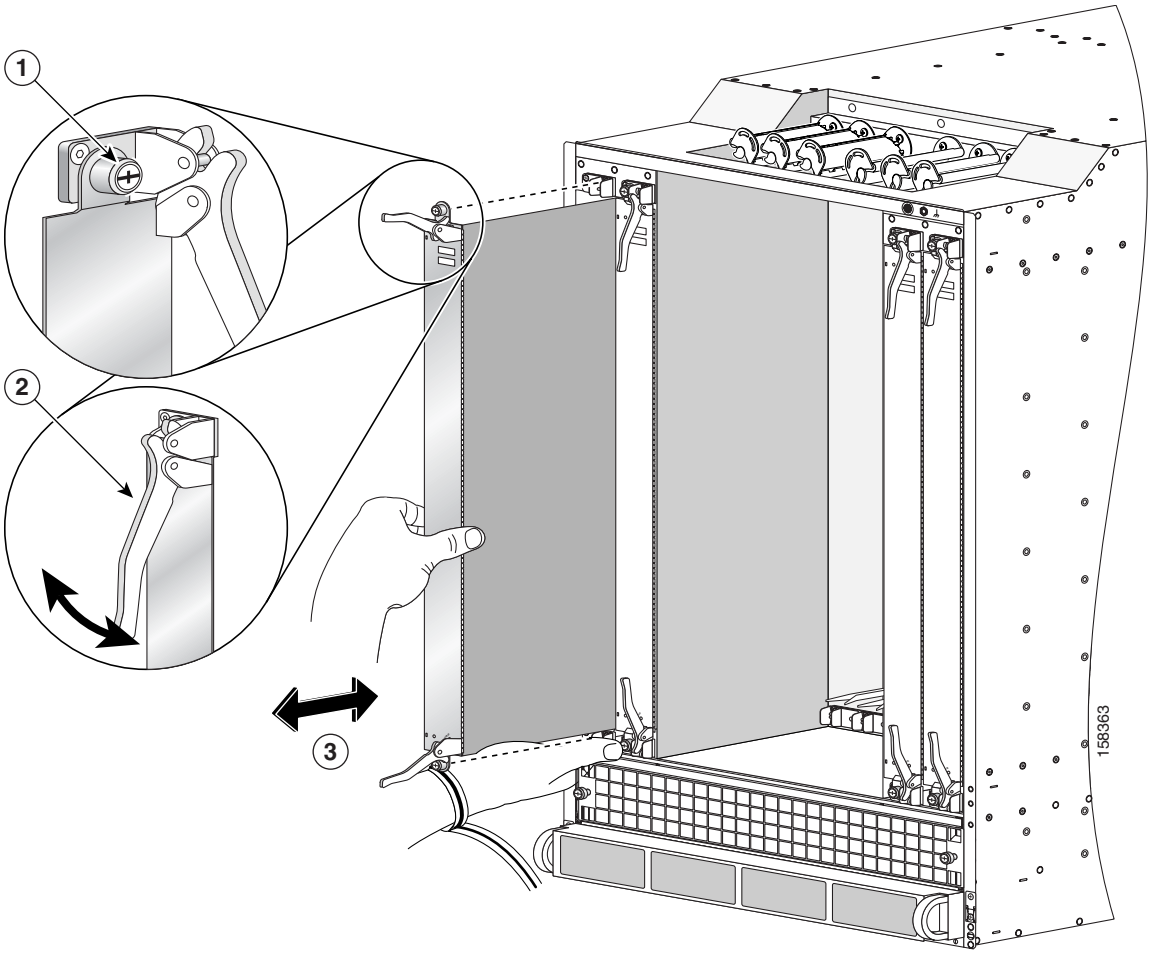
Caution To prevent ESD damage, handle an MSC by its ejector levers or the MSC carrier edges only. Do not touch any of the electrical components, pins, or circuitry.

Step 3 Simultaneously pivot the ejector levers away from the faceplate to release the MSC from the midplane connectors.

Step 4 Grasp the card carrier edges, and gently pull the MSC halfway from the slot (see Figure 4-23).

Step 5 Move one hand under the MSC to guide it. Avoid touching the MSC printed circuit board, components, or any connector pins. Lift cards from the bottom.

Figure 4-23 Removing an MSC



1	Captive screw	**3**	Direction of installation or removal
2	Ejector lever		

Step 6 Place the removed MSC on an antistatic mat, or immediately place it in an antistatic bag if you plan to return it to the factory.

Step 7 If the MSC slot is to remain empty, install an MSC impedance carrier to keep dust from the chassis and maintain proper airflow through the MSC compartment. See the "Installing an Impedance Carrier" section on page 4-10.

Step 8 To ensure proper EMI shielding and to maintain proper airflow throughout the chassis, use a screwdriver to tighten the captive screws next to each impedance carrier ejector lever.

What to Do Next

If you are installing the Cisco CRS-1 4-slot line card chassis for the first time, install the inlet grille and doors. (See Chapter 5, "Installing and Removing the Doors and Grille.")

Verifying the Installation of an MSC

This section describes how to verify that an MSC has been properly installed. (Figure 4-24 shows the front panel of the CRS-MSC. Figure 4-25 shows the front panel of the CRS-MSC-B.)

Figure 4-24 CRS-MSC Front Panel

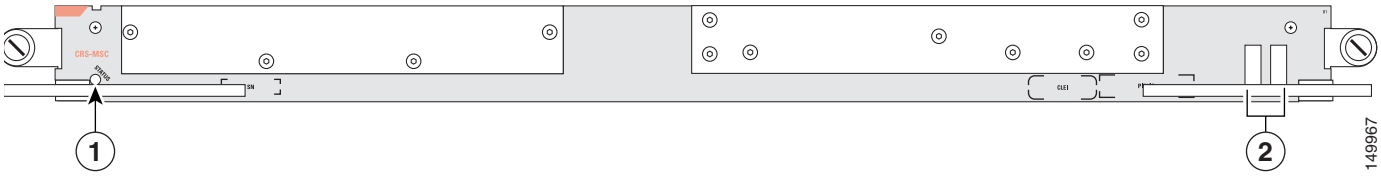
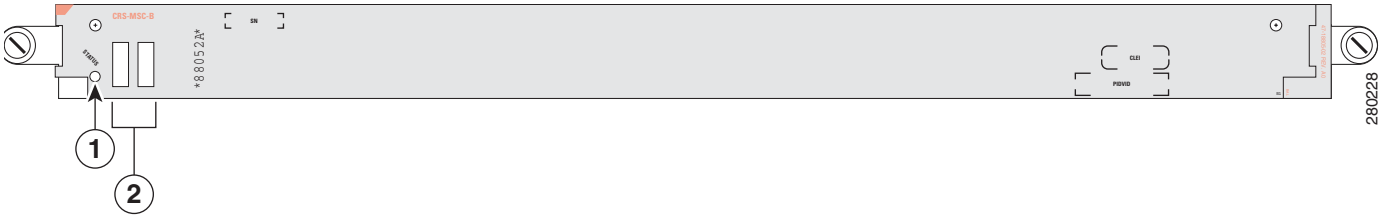


Figure 4-25 CRS-MSC-B Front Panel



1	Status LED	2	Alphanumeric LEDs

Understanding the LEDs

Alphanumeric LEDs

At one end of the faceplate, near an ejector lever, an MSC has two four-digit alphanumeric LED displays that show a sequence of messages indicating the state of the card.

Note It is normal for some displayed messages to appear too briefly in the LED display to be read.

Status LEDs

Use the status LEDs, located on the MSC faceplate, to verify the correct installation of the MSC:

- When the card is properly installed, the Status LED turns green. If this LED is off, verify that the card is installed correctly.
- When the Status LED is blinking yellow, a problem exists on the board.
- When the Status LED is off, the board state is unknown. Verify that there is power to the board by looking at the indicators on the power module.

Troubleshooting the MSC

If the installed or replaced MSC fails to operate or to power up on installation:

- Make sure that the card is seated firmly in the Cisco CRS-1 4-slot line card chassis slot. One easy way to verify physical installation is to see whether the front faceplate of the MSC is even with the fronts of the other cards installed in the card cage.
- Check whether the ejector levers are latched and that the captive screws are fastened properly. If you are uncertain, unlatch the levers, loosen the screws, and attempt to reseat the MSC.
- Examine the Cisco CRS-1 4-slot line card chassis alarm LEDs on the RP to see if there are any active alarm conditions.
- Examine the Cisco CRS-1 4-slot line card chassis power shelves to see whether the chassis, as a whole, is receiving power.

How to Install or Remove a Physical Layer Interface Module

This section contains the following procedures:

- Installing a PLIM
- Removing a PLIM
- Verifying the Installation of a PLIM

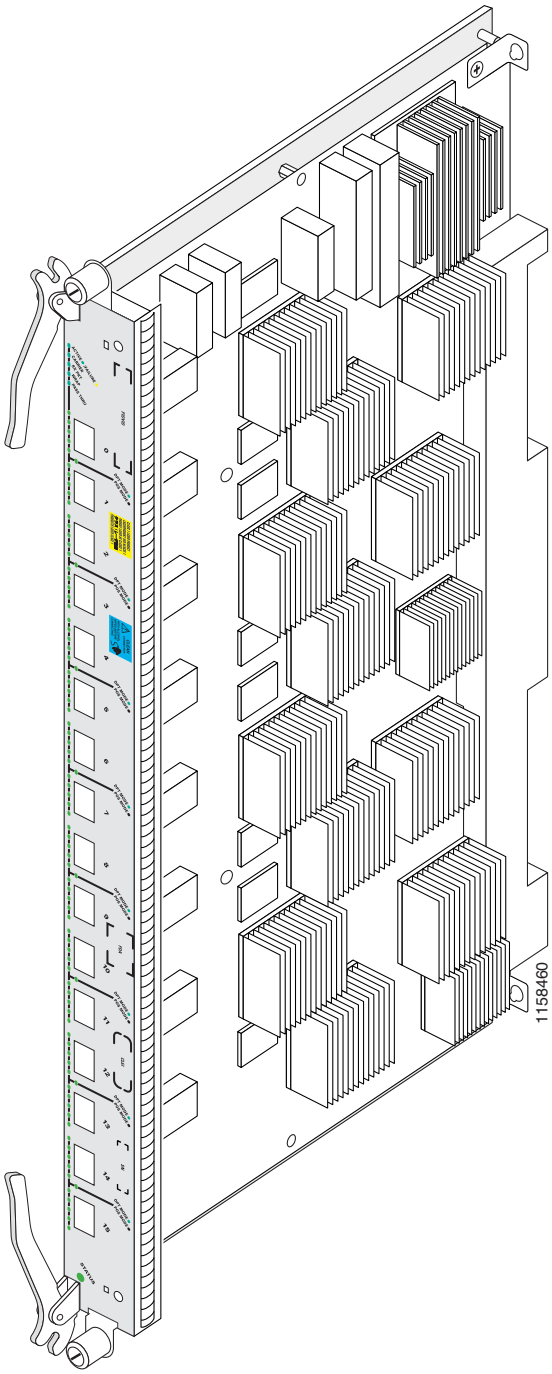
Installing a PLIM

This section describes how to install a physical layer interface module (PLIM) in the Cisco CRS-1 4-slot line card chassis. For more detailed information on PLIMs, see the *Cisco CRS-1 Series Carrier Routing System 4-Slot Line Card Chassis System Description*.

A physical layer interface module (PLIM) is paired with an MSC through the midplane of the chassis. A PLIM provides the ability to choose several interfaces (for example, Packet-over-SONET/SDH [POS]). Figure 4-26 shows a typical PLIM (in this case, a 16 x OC-48c/STM-16c Packet-over-SONET/SDH [POS]).

For information about installing or removing SIPs and SPAs, refer to the *Cisco CRS-1 SIP and SPA Hardware Installation Guide* on www.cisco.com.

Figure 4-26 Physical Layer Interface Module (PLIM)



You can install a PLIM in any of the four center slots in the front of the chassis (see Figure 4-17).

Caution The system may indicate a hardware failure if you do not follow proper procedures. Remove or install only one PLIM at a time. Allow at least 15 seconds for the system to complete the preceding tasks before removing or installing another PLIM.

Prerequisites

Before performing this task, remove any impedance carriers.

Required Tools and Equipment

You need the following tools and part to perform this task:

- ESD-preventive wrist strap
- Medium Phillips screwdriver
- PLIM

Steps

To install a physical layer interface module (PLIM), follow these steps:

Step 1 Go to the front of the chassis. Attach the ESD-preventive wrist strap to your wrist and connect its leash to one of the ESD connection sockets on the front side of the chassis or a bare metal surface on the chassis.

Step 2 Remove the PLIM from its antistatic packaging.

Step 3 Use a medium Phillips screwdriver to remove the PLIM from its protective carrier.

Step 4 Visually inspect the connector pins on the card before you insert it into the chassis.

Note Do not attempt to install a card with bent pins, because this may damage the chassis midplane connectors.

Step 5 Identify the card slot in the card cage where the PLIM should be installed.

a. If there is an impedance carrier in the slot, remove it (see the "Removing an Impedance Carrier" section on page 4-10.)

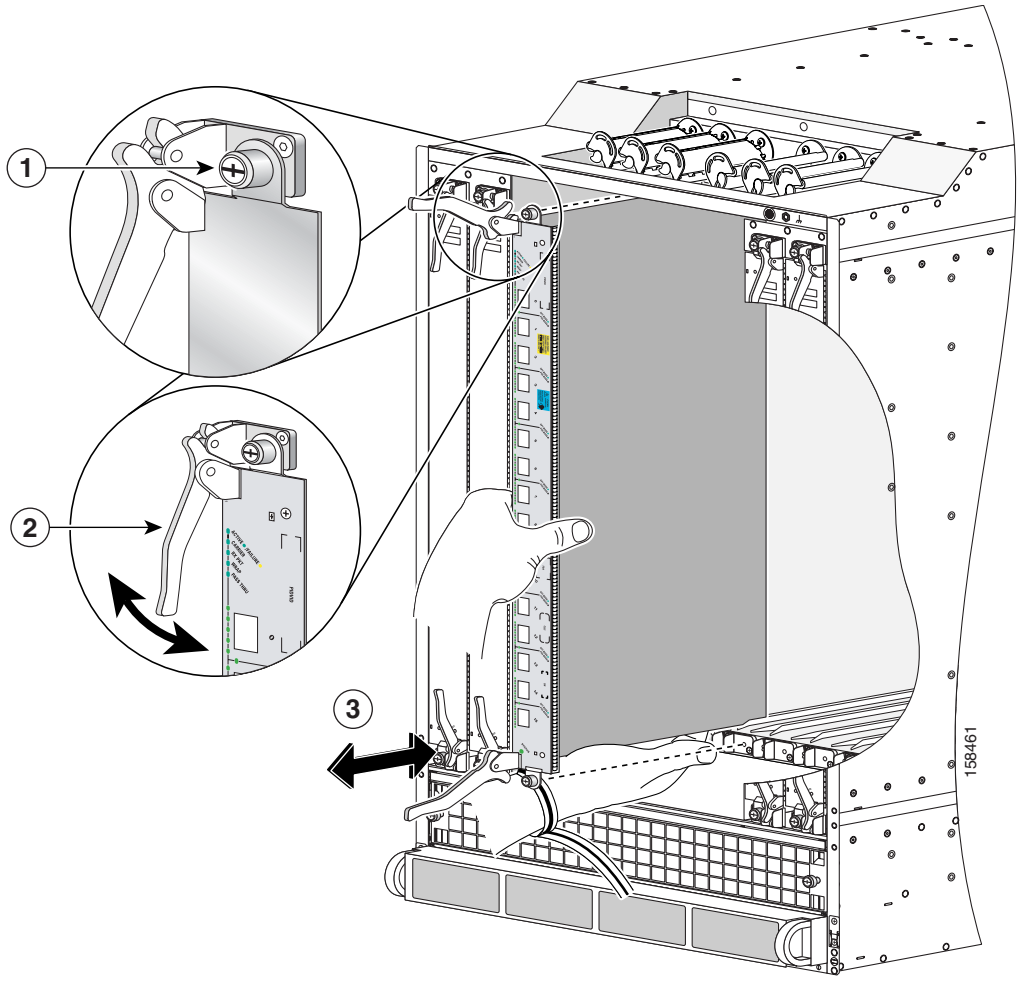
Note Remove only one impedance carrier and install one PLIM at a time. Be sure to verify that each PLIM is fully installed and secured before installing another PLIM.

b. If there is a PLIM already installed in the slot, remove any cables connected to the front panel of an existing card in the slot, then remove the card (see the "Removing a PLIM" section on page 4-46).

c. If you need to remove a Cisco CRS-1 SIP-800, refer to the "Removing a SIP" section in the "Installing and Removing a SIP" chapter of the *Cisco CRS-1 SIP and SPA Hardware Installation Guide* on www.cisco.com.

Step 6 Grasp the face plate of the card with one hand and place your other hand under the card to support and guide it into the correct slot (see Figure 4-27).

Figure 4-27 Installing a PLIM



1	Captive screw	**3**	Direction of installation or removal
2	Ejector lever		

Step 7 Orient the PLIM so that the status display is on top, then position the card for insertion into the card cage slot. Avoid touching the card circuitry or any connectors.

Note There are alignment grooves on each slot in the card cage. When you install a card, make sure that you align both the top and bottom edges of the card carrier in the slot grooves.

Step 8 Grasp both card ejector levers simultaneously, then push them both outward until they are fully extended in the open position.

Step 9 Carefully slide the PLIM into the slot until the ejector levers meet the edges of the card cage, then *stop* when the ejector lever hooks catch the lip of the card cage. If they do not catch, try reinserting the card until the ejector lever hooks are fully latched.

Note PLIMs have guide pins that make initial contact with the midplane connector as you slide a card into its slot.

Step 10 To fully seat the PLIM in the midplane connector, grasp both card ejector levers simultaneously, then push them both inward until they are flush against the front edge of the card carrier. After the guide pins make contact, continue pushing the card carrier until the card ejector levers begin pivoting forward.

Caution Verify that the openings on the card ejector cams pass over the tabs; otherwise, one or both ejector levers may bind when you attempt to close the levers, thereby damaging or breaking one or both of them.

Step 11 To ensure proper EMI shielding and prevent the PLIM from becoming partially dislodged from the midplane, use a screwdriver to fully tighten the captive screws next to each PLIM ejector lever.

Caution To ensure adequate space for additional PLIMs, always tighten the captive installation screws on each newly installed PLIM *before* you insert another PLIM. These captive screws also prevent accidental removal and provide proper grounding and EMI shielding for the system.

Step 12 If applicable to your system, install the SFP optical modules in a PLIM that uses an SFP module, such as the 16-port OC-48 PLIM. See the "Installing a Bale-Clasp SFP Module" section on page 4-53.

What to Do Next

After performing this task:

- Place the impedance carrier in an antistatic bag for storage and future use.
- Verify that the PLIM has been installed properly (see the "Verifying the Installation of a PLIM" section on page 4-49).
- If you are performing the initial installation of the system and the system includes the grille and doors, install those cosmetic components (see Chapter 5, "Installing and Removing the Doors and Grille").

Warnings Regarding PLIM Installation

Some PLIMs contain Class 1 lasers, and some contain Class 1M lasers. See the documentation for the specific PLIM for details.

Warning **Because invisible laser radiation may be emitted from the aperture of the port when no cable is connected, avoid exposure to laser radiation and do not stare into open apertures.** Statement 70

Warning **Class 1 Laser Product.** Statement 113

Warning **Class 1 LED product.** Statement 126

Warning **For diverging beams, viewing the laser output with certain optical instruments within a distance of 100 mm may pose an eye hazard. For collimated beams, viewing the laser output with certain optical instruments designed for use at a distance may pose an eye hazard.** Statement 282

Warning **Laser radiation. Do not view directly with optical instruments. Class 1M laser product.** Statement 283

Removing a PLIM

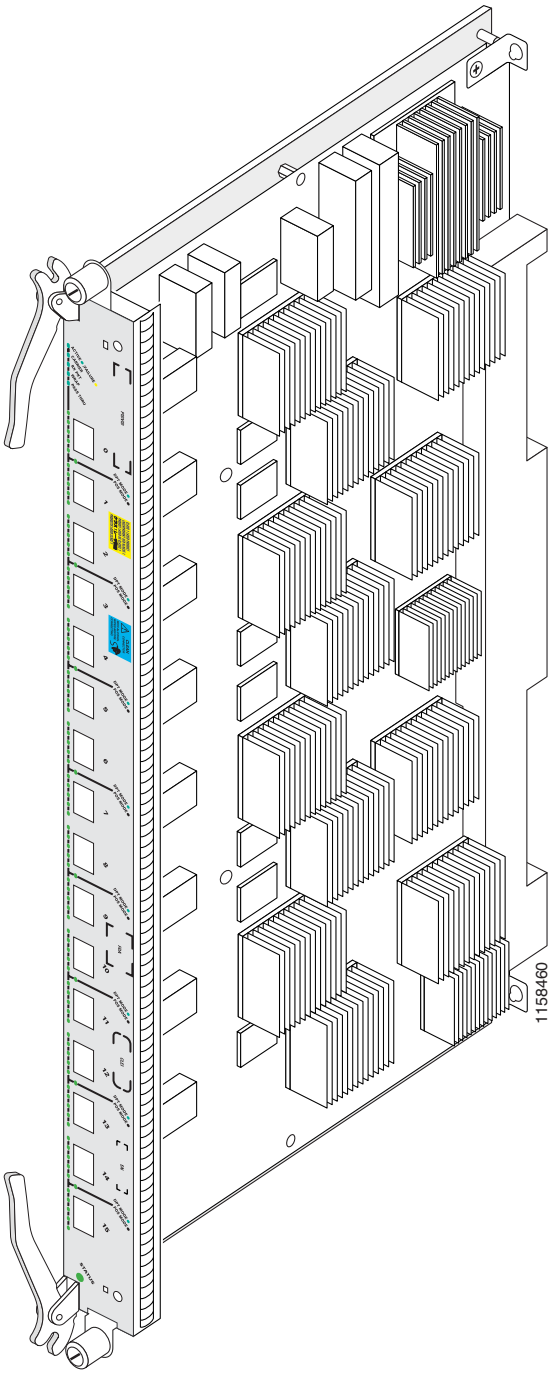
This section describes how to remove a PLIM from the Cisco CRS-1 4-slot line card chassis.

A physical layer interface module (PLIM) is paired with an MSC through the midplane of the chassis. A PLIM provides the ability to choose several interfaces (for example, Packet-over-SONET/SDH [POS]). Figure 4-28 shows a typical PLIM (in this case, a 16 x OC-48c/STM-16c Packet-over-SONET/SDH [POS]).

If you need to remove a Cisco CRS-1 SIP-800, refer to the "Removing a SIP" section in the "Installing and Removing a SIP" chapter of the *Cisco CRS-1 SIP and SPA Hardware Installation Guide* on www.cisco.com.

Note To prevent anomalies when you reinstall a new or reconfigured PLIM, we strongly recommend that you use the **shutdown** command before removing a PLIM. For instructions, refer to the latest release of the *Cisco IOS XR Getting Started Guide*.

Figure 4-28 Physical Layer Interface Module (PLIM)



Prerequisites

Before performing this task, remove the impedance carrier.

Required Tools and Equipment

You need the following tools to perform this task:

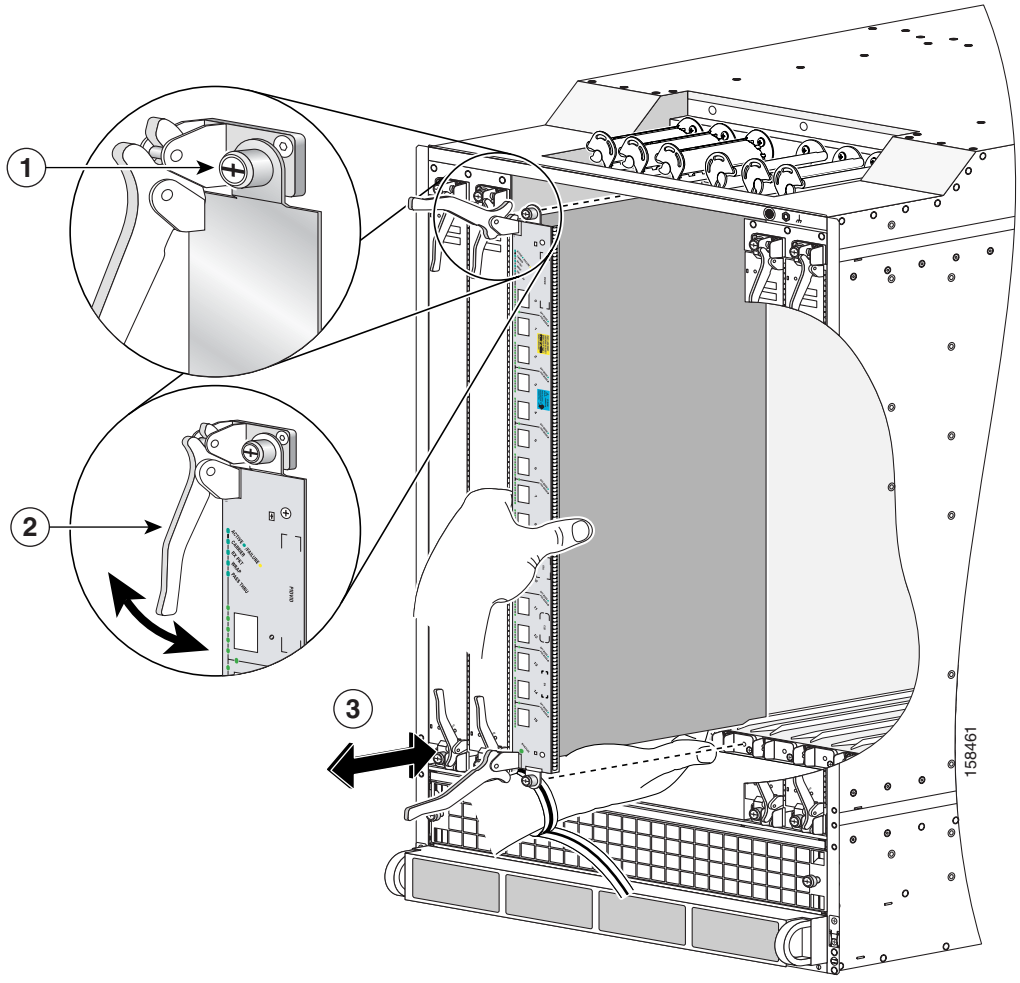
- ESD-preventive wrist strap
- Medium Phillips screwdriver

Warning **Class 1M laser radiation when open. Do not view directly with optical instruments.** Statement 281

Steps

To remove a PLIM, see Figure 4-29 and follow these steps:

Figure 4-29 Removing a PLIM



1	Captive screw	**3**	Direction of installation or removal
2	Ejector lever		

Step 1 Attach the ESD-preventive wrist strap to your wrist and connect its leash to one of the ESD connection sockets on the front (PLIM) side of the chassis or a bare metal surface on the chassis.

Step 2 Identify the card to be replaced.

Step 3 Loosen the two captive screws holding the card in place.

Step 4 Grasp the two card ejector levers and simultaneously pivot both ejector levers 90 degrees (70 degrees for a newer PLIM) away from the front edge of the card carrier to unseat the card from the backplane connector.

Step 5 Grasp the slide-assistance arm (if installed) or the card carrier edges, and gently pull the PLIM halfway from the slot.

Step 6 Move one hand under the PLIM to guide it. Avoid touching the PLIM printed circuit board, components, or any connector pins. *Do not lift cards by the slide-assistance arm*; lift them from the bottom, using the slide-assistance arm only as an aid for balance.

Step 7 Slide the card from the slot and place it directly into an antistatic sack or other ESD-preventive container.

Warning **Because invisible laser radiation may be emitted from the aperture of the port when no cable is connected, avoid exposure to laser radiation and do not stare into open apertures.** Statement 70

Some PLIMs contain Class 1 lasers, and some contain Class 1M lasers. See the documentation for the specific PLIM for details.

What to Do Next

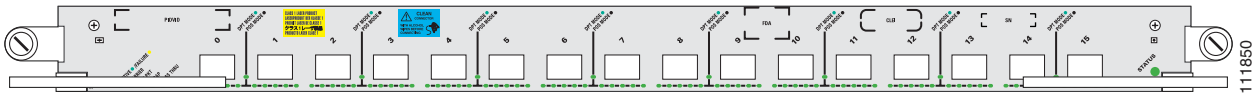
After performing this task, replace any front cover plates.

Verifying the Installation of a PLIM

This section describes how to verify that the PLIM has been properly installed.

Figure 4-30 shows the PLIM front panel (in this case, a 16 x OC-48c/STM-16c Packet-over-SONET/SDH [POS]).

Figure 4-30 PLIM Front Panel



Use the status LEDs, located on the PLIM faceplate, to verify the correct installation of the card:

There are two types of LEDs on a PLIM: the board-level LED labeled **Status** and the port-level LEDs that are labeled differently depending on the PLIM type.

When the PLIM is properly installed, the Status LED turns green. If this LED is off, verify that the PLIM is installed correctly. (For details on the information provided by the port-level LEDs, see the documentation specific to that PLIM.)

Troubleshooting the PLIM

If the installed or replaced PLIM fails to operate or to power up on installation:

- Make sure that the PLIM is seated firmly in the Cisco CRS-1 4-slot line card chassis slot. One easy way to verify physical installation is to see whether the front faceplate of the PLIM is even with the fronts of the other PLIMs installed in the card cage.
- Check whether the ejector levers are latched and that the captive screws are fastened properly. If you are uncertain, unlatch the levers, loosen the screws, and attempt to reseat the PLIM.
- Examine the alarm LEDs on the RP to see if there are any active alarm conditions.
- Examine the power shelves to see whether the chassis, as a whole, is receiving power.

How to Install or Remove a PCMCIA Card

This section contains the following procedures:

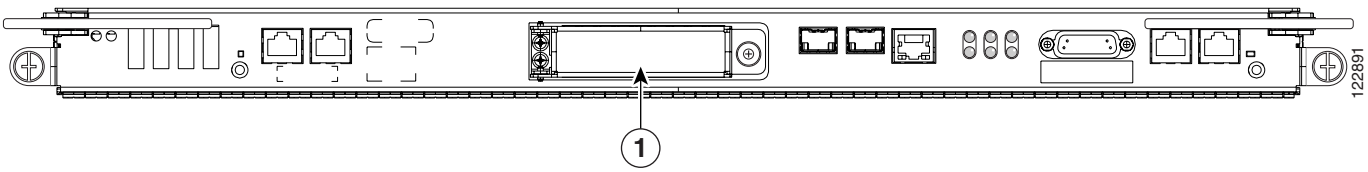
- Installing a PCMCIA Card
- Removing an RP PCMCIA Card

Optional and replaceable PCMCIA cards are available for the RP cards. The RP cards provide two PCMCIA flash slots, each card providing up to 1 GB of flash storage. One of the PCMCIA flash subsystems is accessible externally, is removable, and allows you to transfer system images and configurations by plugging in a PCMCIA flash card. The other subsystem is fixed to the RP, is not removable, and is used for permanent storage of configurations and system images.

Installing a PCMCIA Card

This section describes how to install a PCMCIA card in an RP card PCMCIA slot. For more detailed information on PCMCIA cards, see the *Cisco CRS-1 Carrier Routing System 16-Slot Line Card Chassis System Description*. Figure 4-31 shows you the location of the PCMCIA door in the RP card faceplate.

Figure 4-31 RP Card PCMCIA Slot Door



1	PCMCIA flip-up slot door

Prerequisites

If you are replacing a PCMCIA card, see the "Removing an RP PCMCIA Card" section on page 4-51 to remove the PCMCIA card from the PCMCIA card slot.

Required Tools and Equipment

You need the following tools and part to perform this task:

- ESD-preventive strap
- Medium flat-head screwdriver
- PCMCIA card

Steps

To install a PCMCIA card, follow these steps:

Step 1 Attach the ESD-preventive wrist strap to your wrist and connect its leash to one of the ESD connection sockets on the front (PLIM) side of the chassis or a bare metal surface on the chassis.

Step 2 Using the screwdriver, loosen the captive screw at the bottom of the PCMCIA slot door on the faceplate of the card.

Step 3 While lifting the hinged PCMCIA slot door up, carefully insert the new PCMCIA flash card into the left slot of the PCMCIA card cage. When the card is fully inserted, the release button pops up. (If the button fails to pop up, you may not have the card in right side up; turn the card over and try again.)

Step 4 Close the door to keep dust out, and tighten the captive screw with the screwdriver.

Removing an RP PCMCIA Card

This section describes how to remove a PCMCIA card from an RP card PCMCIA slot. For more detailed information on PCMCIA cards, see the "PCMCIA Cards" section on page 4-4, or the *Cisco CRS-1 Carrier Routing System 16-Slot Line Card Chassis System Description*. Figure 4-31 on page 4-50 shows you the location of the PCMCIA door in the RP card faceplate.

Prerequisites

Before performing this task, remove any front (PLIM) side cover plates.

Required Tools and Equipment

You need the following tools to perform this task:

- ESD-preventive strap
- Medium Phillips screwdriver

Steps

To remove the PCMCIA card, follow these steps:

Step 1 Attach the ESD-preventive wrist strap to your wrist and connect its leash to one of the ESD connection sockets on the front (PLIM) side of the chassis or a bare metal surface on the chassis.

Step 2 Using the screwdriver, loosen the captive screw at the bottom of the PCMCIA slot door on the faceplate of the card.

Step 3 While lifting the hinged PCMCIA slot door up, press the release button for the card slot to disengage the card from the card, and then carefully pull out the far left removable PCMCIA flash card.

Step 4 Place the removed PCMCIA card on an antistatic mat, or immediately place it in an antistatic bag if you plan to return it to the factory.

Step 5 If the PCMCIA card slot is to remain empty, close the door to keep dust out and tighten the captive screw with the screwdriver. Otherwise, install the new PCMCIA card.

What to Do Next

If you intend to install a new PCMCIA card, see the "Installing a PCMCIA Card" section on page 4-50.

How to Install or Remove a Small Form-Factor Pluggable (SFP) Module

This section contains the following procedures:

- Installing a Bale-Clasp SFP Module
- Removing a Bale-Clasp SFP Module

For general information about SFP modules, see the "Small Form-Factor Pluggable (SFP) Modules" section on page 4-4. For information on SFP optical cleaning, see "Inspection and Cleaning Procedures for Fiber-Optic Connections," at the following URL:

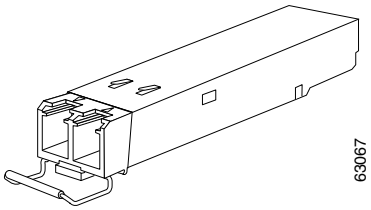
http://www.cisco.com/warp/public/127/cleanfiber2.html.

Warning **Because invisible laser radiation may be emitted from the aperture of the port when no cable is connected, avoid exposure to laser radiation and do not stare into open apertures.** Statement 70

Installing a Bale-Clasp SFP Module

This section describes how to install a bale-clasp SFP module. The module has a clasp used to install and remove the module (see Figure 4-32).

Figure 4-32 Bale-Clasp SFP Module



Prerequisites

Before installing a module, remove any front cover plates.

Required Tools and Equipment

You need the following tools and part to perform this task:

- ESD-preventive wrist strap
- Bale-clasp SFP module

Steps

To install a bale-clasp SFP module (into a PLIM), follow these steps:

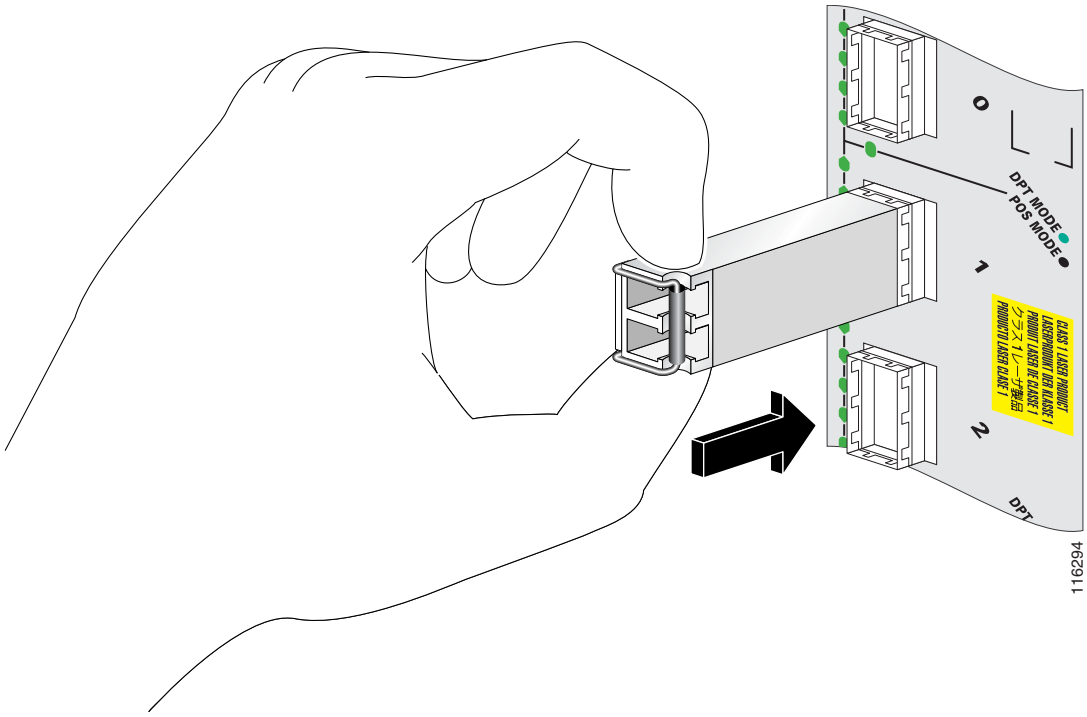
Step 1 Attach the ESD-preventive wrist strap to your wrist and connect its leash to one of the ESD connection sockets on the front (PLIM) side of the chassis or a bare metal surface on the chassis.

Step 2 Close the bale clasp before inserting the module.

Step 3 Align the module with the port and slide it into the port (see Figure 4-33).

Note Be careful to hold the module in such a way so as to not damage the bale clasp.

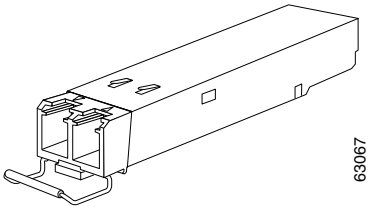
Figure 4-33 Installing a Bale-Clasp SFP Module into a Port



Removing a Bale-Clasp SFP Module

This section describes how to remove a bale-clasp SFP module. The module has a clasp used to install and remove the module (see Figure 4-34).

Figure 4-34 Bale-Clasp SFP Module



Prerequisites

Before removing a module, disconnect any connected interface cables.

Required Tools and Equipment

You need the following tools to perform this task:

- ESD-preventive wrist strap
- Small flat-blade screwdriver

Steps

To remove a bale-clasp SFP module from a PLIM, follow these steps:

Step 1 Attach the ESD-preventive wrist strap to your wrist and connect its leash to one of the ESD connection sockets on the front (PLIM) side of the chassis or a bare metal surface on the chassis.

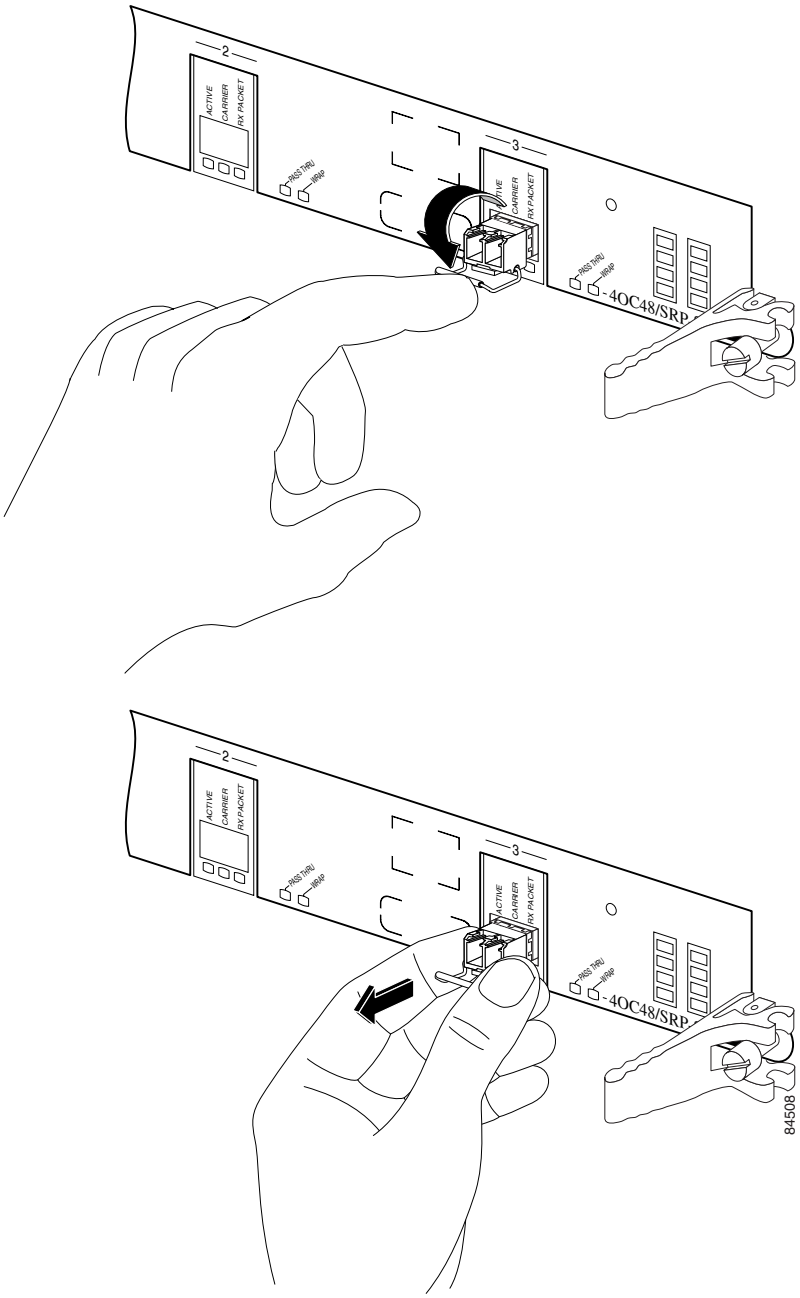
Step 2 Disconnect and remove all interface cables from the ports. Be sure to note the current connections of the cables to the ports on the PLIM.

Step 3 Open the bale-clasp on the module with your index finger in a downward direction (see Figure 4-35). If the bale-clasp is obstructed and you cannot use your index finger to open it, use a small screwdriver or other long, narrow instrument to open the bale-clasp.

Step 4 Grasp the module between your thumb and index finger and carefully remove it from the port (see Figure 4-35).

Note Be careful to hold the module in such a way so as to not damage the bale-clasp.

Figure 4-35 Removing a Bale-Clasp SFP Module



Step 5 Place the removed module on an antistatic mat, or immediately place it in a static-shielding bag if you plan to return it to the factory.

Step 6 Protect the PLIM by inserting clean SFP module cage covers into the optical module cage when there is no module installed.

CHAPTER 5

Installing and Removing the Doors and Grille

This chapter provides instructions on how to install and remove the front doors and inlet grille on the Cisco CRS-1 Carrier Routing System 4-Slot Line Card Chassis.

This chapter presents the following topics:

- Overview of the Exterior Components
- Installing the Inlet Grille
- Removing the Inlet Grille
- Installing the Doors
- Opening the Doors
- Removing the Doors

Overview of the Exterior Components

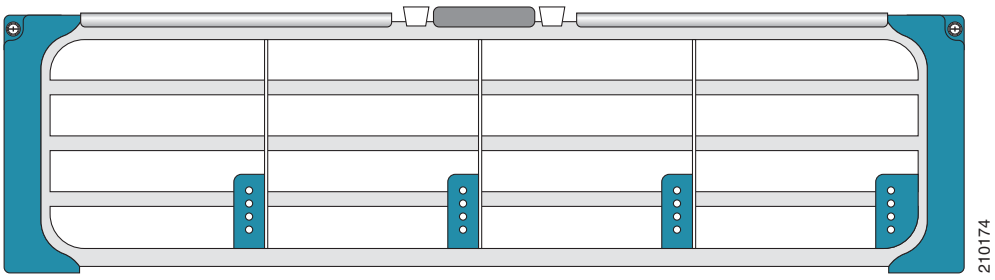
Exterior cosmetic components for the Cisco CRS-1 4-slot line card chassis are not required to be installed; they are provided as optional components (except for the cable management bracket, which is preinstalled). The the Cisco CRS-1 4-slot line card chassis is shipped with the following exterior components:

- Cable management bracket. Shipped preinstalled on the chassis.
- Inlet grille. If the cosmetic kit was ordered, the inlet grille is included in the door kit.
- Front doors. Cisco CRS-1 4-Slot Line Card Chassis Front Door kit (Cisco product number: CRS-4-DOOR-KIT=)

Installing the Inlet Grille

This section describes how to install the inlet grille. The inlet grille covers the power supply and air intake areas at the bottom of the front side of the chassis, just below the card cage (see Figure 5-1).

Figure 5-1 Inlet Grille



Prerequisites

There are no prerequisites for installing the inlet grille.

Required Tools and Equipment

You need the following tools and part to perform this task:

- ESD-preventive wrist strap
- Inlet grille
- Number 2 flat screwdriver

Steps

To install the inlet grille, follow these steps:

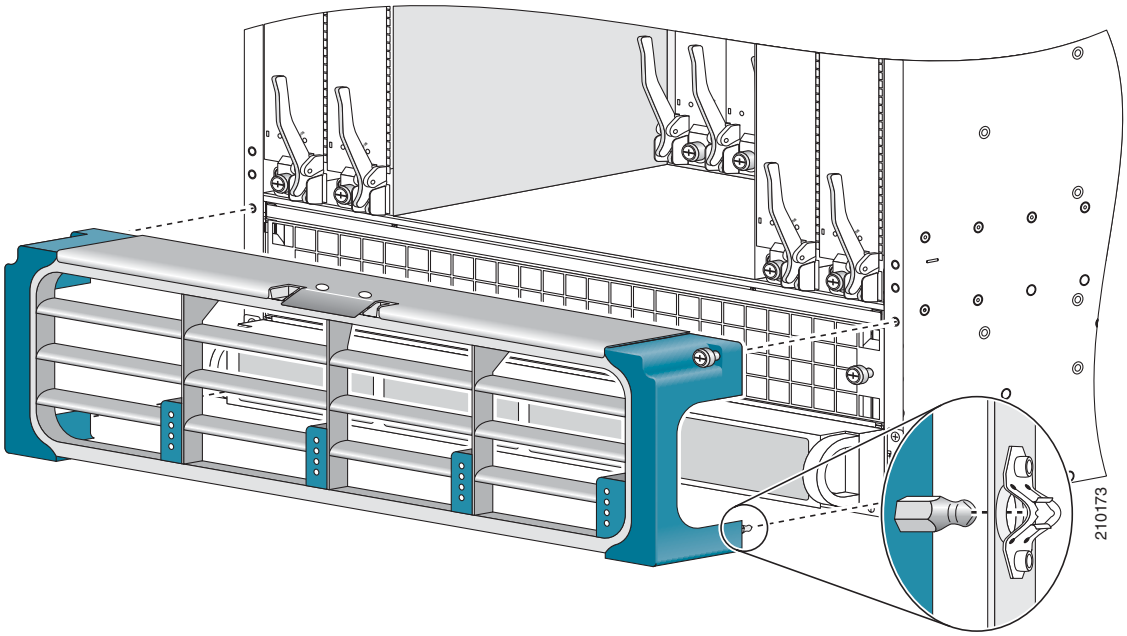
Step 1 Remove the inlet grille from its packaging, then set the packaging aside.

The inlet grille is packaged in the door assembly box.

Step 2 Attach the ESD-preventive wrist strap to your wrist and connect its leash to an ESD connection socket on the front side or a bare metal surface on the chassis.

Step 3 Align the ball studs at the bottom of the inlet grille with the cutouts at the bottom of the chassis casing on the front side of the chassis, just in front of the power supplies (see Figure 5-2).

Figure 5-2 Aligning the Inlet Grille



Step 4 Push the inlet grille toward the chassis, and snap the ball studs into place.

Step 5 Make sure you align the light pipes to the corresponding openings in the power filter.

Step 6 With a Number 2 flat screwdriver, tighten the two captured screws at the upper right and left corners of the grille.

What to Do Next

You can now install the doors (see the "Installing the Doors" section on page 5-4).

Removing the Inlet Grille

This section describes how to remove the inlet grille. The grille covers the power module and air intake areas at the bottom of the front (PLIM) side of the chassis, just below the card cage.

Prerequisites

No prerequisites exist for this task.

Required Tools and Equipment

You need the following tools to perform this task:

- ESD-preventive wrist strap
- Number 2 flat screwdriver

Steps

To remove the inlet grille, follow these steps:

Step 1 Attach the ESD-preventive wrist strap to your wrist and connect its leash to an ESD connection socket on the front side or a bare metal surface on the chassis.

Step 2 If the doors have been installed, open the doors to get complete access to the grille.

Step 3 Using the Number 2 flat-blade screwdriver, unscrew the two captured screws at the upper right and left corners of the grille.

Step 4 Firmly grasp the outside edges of the inlet grille.

Step 5 Pull the bottom of the grille firmly away from the chassis; it loosens from the connecting ball studs.

Step 6 Carefully set the inlet grille aside.

Installing the Doors

This section describes how to install the doors on the Cisco CRS-1 4-slot chassis. We recommend that you install the doors when the chassis has been mounted into its rack.

Prerequisites

Before you install the doors on the Cisco CRS-1 4-slot chassis, you must install the grille as described above.

Required Tools and Equipment

You need the following tool and parts to perform this task:

- ESD-preventive wrist strap
- Left and right doors (Cisco product number: CRS-4-DOOR-KIT)

Steps

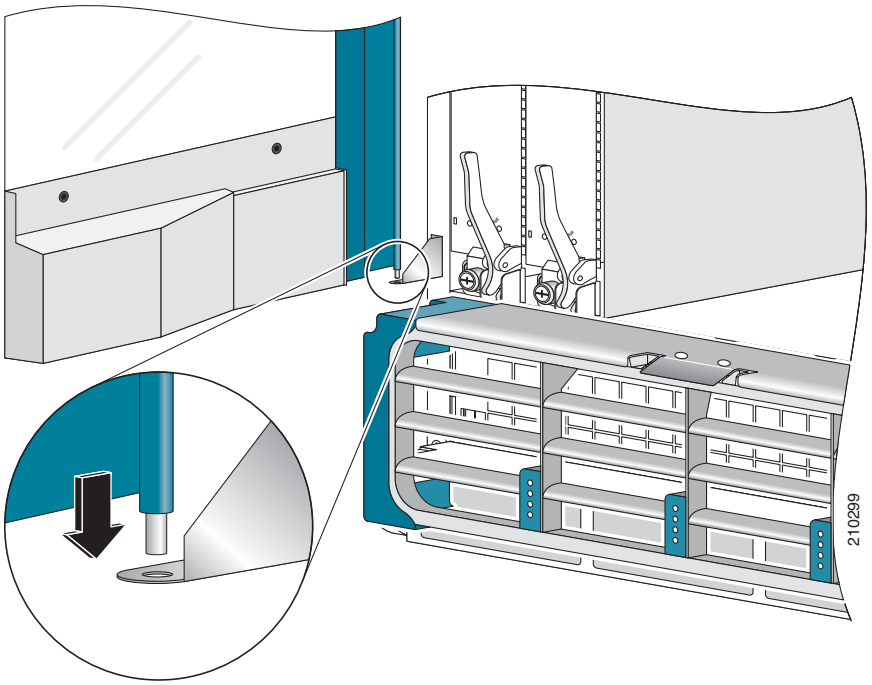
To install the doors on the Cisco CRS-1 4-slot chassis, follow these steps:

Step 1 Remove the door from its packaging (including the protective film that covers each door), and set the packaging aside.

Step 2 Attach the ESD-preventive wrist strap to your wrist; then connect its leash to an ESD connection socket or a bare metal surface on the chassis.

Step 3 Starting with the left door, align the bottom guide pin over the hole in the lower door mounting bracket (see Figure 5-3).

Figure 5-3 Setting the Door Into the Lower Door Mounting Bracket

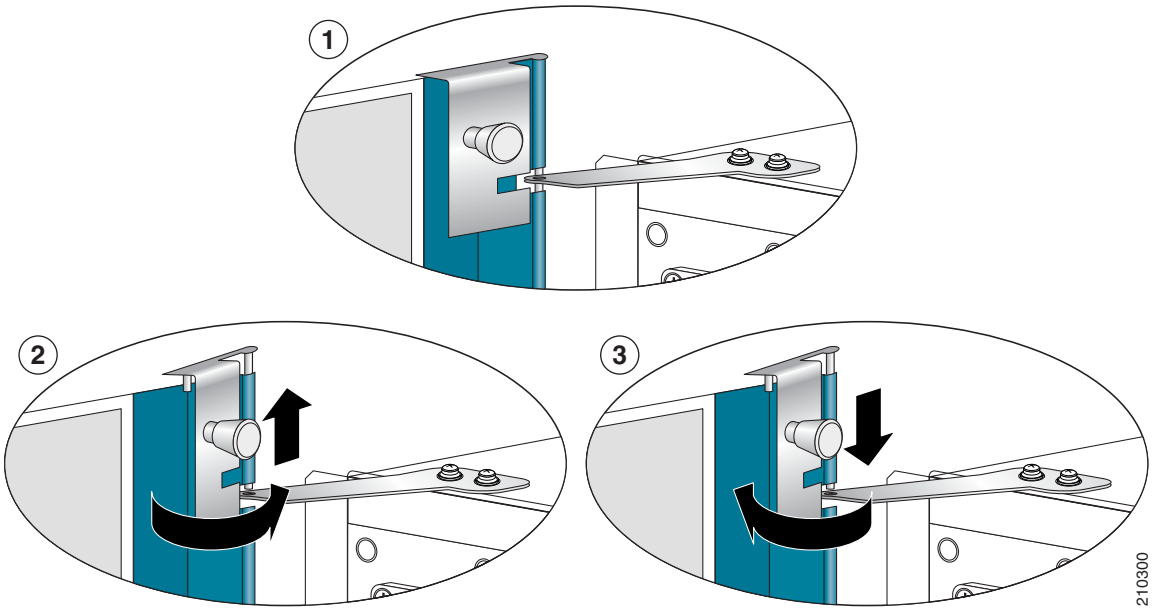


Step 4 Drop the door's bottom guide pin into the lower door mounting bracket hole (see Figure 5-3).

Step 5 Now secure the upper portion of the door. Keeping the door steady with one hand, align the door groove (on the upper inside portion of the door) with the upper door mounting bracket (see Step 1 in Figure 5-4).

Step 6 Pull the knob latch out, then lift the knob latch up so that the securing pin clears the upper door mounting bracket (see Step 2 in Figure 5-4).

Figure 5-4 Using the Knob Latch to Secure the Top of the Door



Tip Observe that there is a guide pin on top of the knob latch.

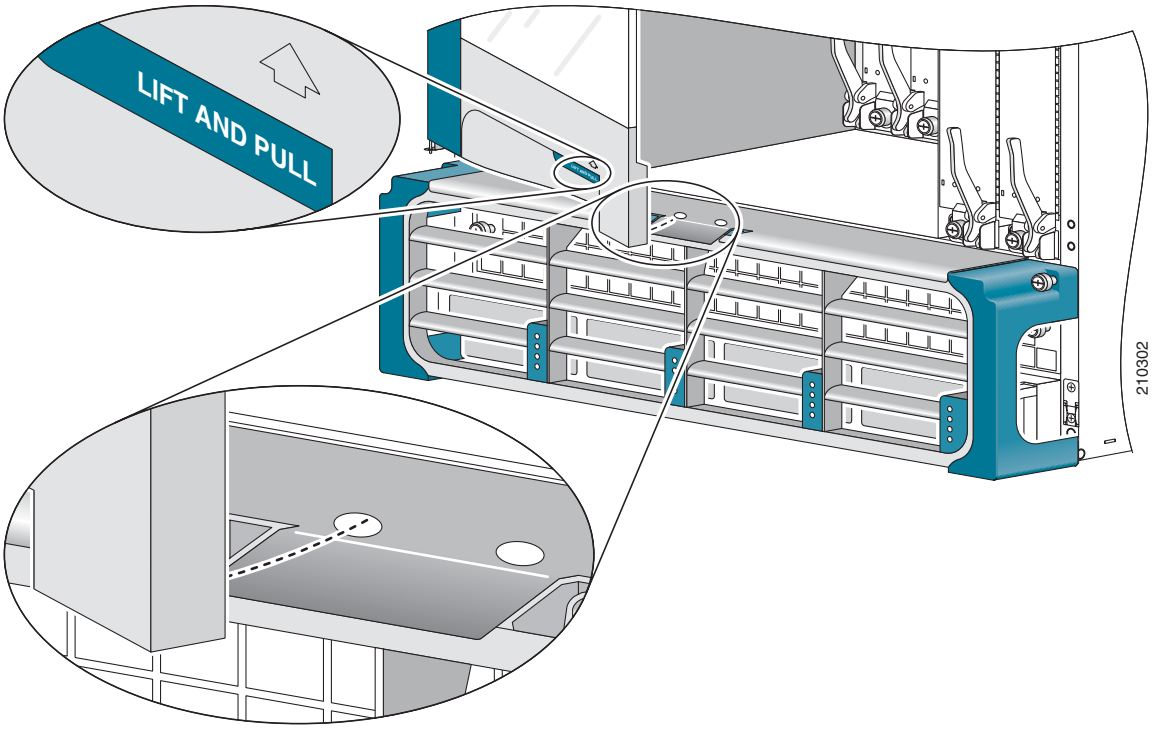
Step 7 Keeping the knob latch at a shallow angle, align the securing pin and guide pin with the upper door mounting bracket.

Note You must align both the knob latch and the guide pin before the securing pin will drop properly.

Step 8 Pull the knob out, then drop the securing pin into the mounting bracket (see Step 3 in Figure 5-4).

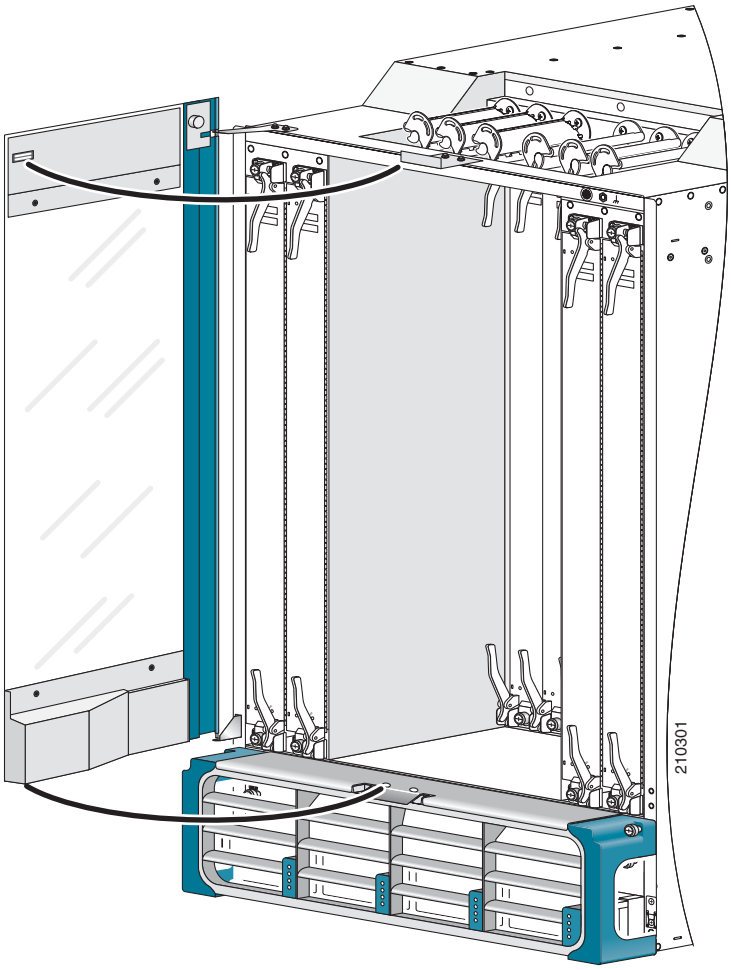
Step 9 To close the door, lift the latch button at the base of the door (see Figure 5-5), then push the door closed.

Figure 5-5 Lifting the Latch Button to Open the Door



It will snap closed when the door's magnets (on the inside top of the door) snap into place and the latching pin on the bottom of the door falls into the receiving holes on the striker panel (see Figure 5-6).

Figure 5-6 Closing the Door



Step 10 Repeat this procedure for the right door.

Opening the Doors

To open the doors on the Cisco CRS-1 4-slot line card chassis, follow these steps:

Step 1 Lift the latch button at the base of the door (as shown in Figure 5-5 on page 5-6).

Step 2 Pull the door open.

Removing the Doors

To remove the doors from the Cisco CRS-1 4-slot line card chassis, follow these steps:

Step 1 Open the door you want to remove.

Step 2 While supporting the door with one hand, reach inside the door, pull out the knob latch, then lift the latch out from the upper door mounting bracket.

Step 3 With both hands grasping the door, lift the door out of the lower door mounting bracket.

Step 4 Place the door in a safe storage box.

Step 5 Repeat this procedure for the other door.

APPENDIX A

Cisco CRS-1 4-Slot Line Card Chassis System Specifications

This appendix provides the specifications for the Cisco CRS-1 Carrier Routing System 4-Slot Line Card Chassis. It contains the following sections:

- Compliance and Safety Reference
- Cisco CRS-1 4-Slot Line Card Chassis Specifications
- Environmental Specifications

Compliance and Safety Reference

For information about the compliance and safety standards with which the Cisco CRS-1 router conforms, see *Cisco CRS-1 Carrier Routing System Regulatory Compliance and Safety Information*.

Note Statement 273, Blower Handle Warning, is applicable only to the Cisco CRS-1 4-slot line card chassis.

Cisco CRS-1 4-Slot Line Card Chassis Specifications

Table A-1 lists the specifications for the Cisco CRS-1 Carrier Routing System 4-Slot Line Card Chassis.

Table A-1 Cisco CRS-1 4-Slot Line Card Chassis Specifications

Physical Dimensions	
Height	30 in. (76.2 cm)
Depth	30.28 in. (76.9 cm) (including front doors)
Width	17.65 in. (44.8 cm)
Weight	
Chassis with fan tray, power shelf, and impedance carriers installed (as shipped)	260 lb (117.9 kg), chassis only 338 lb (153.3 kg), chassis including packaging and pallet

Table A-1 Cisco CRS-1 4-Slot Line Card Chassis Specifications (continued)

Chassis with all components installed (without exterior cosmetic components and packaging)	361 lb (163.7 kg)
Cards and Modules Supported	4 modular services cards (MSCs) 4 physical layer interface modules (PLIMs) or 4 shared port adapter (SPA) interface processors (SIPs), each of which supports one or more SPAs 2 route processors (RPs) 4 switch fabric cards 1 fan tray
Power Shelves	
AC power shelf	Supports four AC-to-DC rectifiers
DC power shelf	Supports four DC power supplies
Maximum Power Consumption	Total input power
Maximum AC input power	4185 W (assuming 92% efficiency)
Maximum DC input power	4278 W (assuming 90% efficiency)
DC power lug torque ranges	
Minimum torque	20 in-lb (2.2 N-m)
Maximum torque	30 in-lb (3.3 N-m)
Power Redundancy	
AC	1:1—Requires two independent AC sources
DC	We recommend two independent -48 VDC power sources
AC Input Power	2W+PE (2 wire + protective earthing[1])
Nominal input voltage	200 to 240 VAC (range: 180 to 264 VAC)
Nominal line frequency	50 or 60 Hz (range: 47 to 63 Hz)
Recommended AC service	20 A (per AC rectifier)
DC Input Power	
Nominal input voltage	Supports -48 VDC and -60 VDC systems (range: –40 to –72 VDC)
Input line current	50-A maximum at –48 VDC 40-A maximum at –60 VDC
Inrush current	60-A peak at 75 VDC (maximum for 1 ms)
Chassis Cooling	1 fan tray, pull configuration
Chassis airflow	Up to 880 cubic ft (24,919 liters) per minute
Power shelf airflow	60 cubic ft (1699 liters) per minute

1. Protective earthing conductor (ground wire).

Environmental Specifications

Table A-2 lists the environmental specifications for the Cisco CRS-1 4-slot line card chassis.

Table A-2 Cisco CRS-1 4-Slot Line Card Chassis Environmental Specifications

Description	Value
Temperature	Operating, nominal: 41° to 104°F (5° to 40°C) Operating, short-term: 23° to 122°F (–5° to 50°C)[1] Nonoperating: –40° to 158°F (–40° to 70°C)
Humidity	Operating: 5% to 85% noncondensing Nonoperating: 5% to 90% noncondensing, short-term operation
Altitude	–197 to 5906 ft (–60 to 1800 m) at 122°F (50°C), short-term Up to 10,000 ft (3048 m) at 104°F (40°C) or below
Heat dissipation	• AC: 14,280 BTU per hour (maximum) • DC: 14,597 BTU per hour (maximum)
Power density	12,406 W per sq. meter (maximum)
Average air exhaust temperature	129°F (54°C)—At room temperatures of 95 to 102°F (35 to 39°C) 149°F (65°C)—Maximum exhaust temperature on a fully loaded system during worst-case operating conditions (50°C and 6000 ft altitude)
Acoustic noise	Fans at normal to moderate speed: 67 dBa—front of chassis 77 dBa—rear of chassis Fans at maximum speed (7500 RPM): 83 dBa—front of chassis 93 dBa—rear of chassis
Shock and vibration	Designed and tested to meet the NEBS shock and vibration standards defined in GR-63-CORE (Issue 2, April 2002).

1. “Short-term” refers to a period of not more than 96 consecutive hours and a total of not more than 15 days in one year. This refers to a total of 360 hours in any given year, but no more than 15 occurrences during that one-year period.

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